HERNIA

BY

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PREFACE

I have written this book for two reasons Firstly because it gives me the chance to assemble a number of scattered contributions that I have made in the past Secondly because I believe that there is room in this branch of surgery more than any other for a review that is personal and dogmatic rather than transcriptive and obsequious Having taught anatomy for three years and worked at general surgery for ten times that period, I have formed views about the anatomy of the inguinal canal that I know to be unorthodox but that I believe to be sound Having operated on many herniae I have arrived at methods of repair that I consider to be rational and that have in my hands stood the test of time I cannot claim a complete follow up a luxury that is possible only to those who have University Grants or a large private income but I have made a sincere effort to encourage the reporting of failures In two closed communities that provide most of my hernia patients I think I have succeeded I have tried to give reasons for my recommendations and equally to give reasons for my dislikes

I have re-used some ideas and occasionally re-used phrases that appeared for the first time in my section on Hernia in Maingot s *Post-Graduate Surgery* in 1936 I am very grateful to Mr Rodney Maingot for permission to do this

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CHAPTER 1

The Place of Apparatus

A hernia is defined as the displacement of an organ from the cavity in which it is usually contained through an opening in the walls of that cavity The term is normally used in connexion with herniation of the abdominal contents through the abdominal parietes and the opening through which herniation occurs is either a natural foramen or channel through which blood vessels or other structures leave the abdomen, or the site of some injury Thus the common hernial sites are the inguinal and crural canals the umbilicus the oesophageal hiatus in the diaphragm and the scars of operations or war wounds When however prolonged or repeated increase of abdominal pressure coincides with general wasting almost any of the fibrous junctions in the abdominal wall may give way Thus in the old and debilitated inmates of geriatric institutions whose abdominal walls wasted by disease and malnutrition, are subjected to the strain of constant coughing it is not uncommon to find four distinct hernias in each groin protrusions through the linea semilunaris and under Poupart s ligament lateral to the femoral artery in addition to the more common inguinal and femoral ones

A patient sometimes comes for advice about a large hernia which he has noticed accidentally only within the last few days though he has clearly had it for months or years Another will say that he has known of the swelling for several years but he did not report it earlier because it has given him no trouble and has not increased appreciably in size Usually however a hernia causes some disability from the start In any case when a surgeon has discovered a hernia whether or not it appears to be giving trouble he must advise control or cure that is some retentive or protective apparatus or an operation No hernia left to itself will undergo cure nor can it be guaranteed to remain stationary or even tolerable for any length of time The hernia is the result of abdominal pressure acting on a weak spot Abdominal pressure is a continuous force keeping the viscera in position against

the force of gravity driving the blood in the great veins back to the heart and aiding the return of the diaphragm after its descent It is increased in order to expel the contents of the abdominal or thoracic viscera, in vomiting micturition defaecation, parturition and coughing or to fix the trunk as a base for the limbs in muscular work With this force constantly acting any hernia is bound to increase in size and the hernia in turn will tend to inhibit or interfere with abdominal movements and to give a sense of insecurity during any strenuous exertion To these disabilities is added the danger of strangulation present at all times in some herniae appearing only later in others Thus no hernia may safely be disregarded and some form of treatment should be urged as soon as the diagnosis is certain

Because it is inherent in human nature to avoid any course that involves risk, pain expense or loss of time many patients will wish first to discuss the question of a truss The success of surgical repair in herniae of moderate size is sufficiently well known to induce the majority of active and healthy men to demand operation On the other hand the skilfully worded advertisements of those who claim to build up the tissues by patent apparatus most of which are rather clumsy trusses relying on rubber bands instead of springs oblige the surgeon to discuss in simple terms the pros and cons of treatment by apparatus

In general terms it must be pointed out that a truss must not be expected to cure a hernia but merely to retain it It must be worn permanently not merely for the rest of the patient s waking active life but in most cases at all times of the day and night It is therefore irksome to an extent that varies with the sensibility of the patient the type and strength of the apparatus that he requires the nature of his work, and the delicacy of his skin. It is effective only if it is made exactly worn constantly kept in repair and renewed when weak. It is more effective in some types of hernia than in others but in all it is liable to produce some degree of pressure atrophy and therefore to become less effective with time On these general grounds alone the adoption of apparatus should be discouraged in the young and healthy

The place of the truss

Two questions are often asked. Can a truss cure a hernia? and Can a well made truss retain a hernia prevent it enlarging and allow work in reasonable comfort without the risk of strangulation?

A truss may be able to cure an inguinal or an umbilical hernia in an infant but these alone A congenital inguinal hernia is due to the persistence in whole or in part of the processus funicularis or the canal of Nück, diverticula from the coelomic cavity that normally remain patent till just before birth Persistence of the peritoneal pouch after this somewhat arbitrary date is evidence of delay but not necessarily of failure in the process of obliteration which may take place some weeks or even months later Such a natural cure is possible only if the empty sac is never distended A truss must therefore be well made and must be worn day and night for the first year A skein of wool truss is perfectly useless If the hernia comes down during this trial period the chance of cure is probably lost and if it appears after a year natural closure is no longer possible

It has been stated that the prolonged wearing of a truss may bring about the natural cure of an inguinal hernia even in adult life through the obliteration of the sac at its neck by adhesions It is however most unlikely that adhesions will occur exactly at the ring or that they will obliterate the lumen completely Adhesions that follow the wearing of a truss are usually between the sac wall and its contents and not at the neck of the sac but half an inch or so farther down further they are usually bands or partial adhesions Such attempts at repair have no value in preventing the entry of bowel into the sac but rather favour strangulation if it does come down

The second question whether a truss can retain a hernia with comfort and safety can only be answered with regard to particular herniae

Oblique inguinal hernia

If the hernia is an early one that is if the neck is small the internal ring neither stretched nor displaced inwards and if the muscles are good or put in another way if the hernia when reduced with the patient standing will not come down unless he coughs strains or walks about it can be retained by a well fitting truss against any but the most violent straining efforts On the other hand, this type of hernia is normally seen in healthy young men, it is one for which a simple type of operation is sufficient and in which a permanent cure is almost certain. In proportion as the hernia is old the internal ring enlarged the muscles weak or the patient s occupation a strenuous one a truss will be less effective The continued pressure of a truss tends in time to produce atrophy of the inguinal muscles, thickening

the force of gravity driving the blood in the great veins back to the heart and aiding the return of the diaphragm after its descent It is increased in order to expel the contents of the abdominal or thoracic viscera in vomiting micturition defaecation, parturition and coughing or to fix the trunk as a base for the limbs in muscular work With this force constantly acting any hernia is bound to increase in size and the hernia in turn will tend to inhibit or interfere with abdominal movements and to give a sense of insecurity during any strenuous exertion To these disabilities is added the danger of strangulation present at all times in some herniae appearing only later in others Thus no hernia may safely be disregarded and some form of treatment should be urged as soon as the diagnosis is certain

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of the sac near the internal ring and adhesions between the sac and its coverings and contents Such changes have two results Abdominal contents coming down into a hernia pressed on by a truss are more likely to become strangulated and an operation for repair when it is required cannot rely upon simple removal of the sac but must include some plastic manœuvre to reinforce the inguinal canal

Direct inguinal hernia

A direct hernia unless it is really large is particularly suitable for a truss It appears late in life it tends to enlarge very slowly it can be retained by the simple backward pressure of a pad and when so retained it will not enlarge appreciably over many years The sac is a wide-mouthed bulge and there is no tendency for adhesions to form in or around it or for bowel to be trapped in it Many seamen and general labourers are able to carry on their strenuous callings wearing double inguinal trusses for direct hernia without appreciable loss of efficiency

Femoral hernia

In inguinal hernia a truss is often effective and it is discountenanced merely because it is unwise In femoral hernia on the other hand a truss should be recommended only for exceptional reasons The hawker of patent apparatus will claim to cure all herniae femoral as well as inguinal but a survey of the anatomical features of femoral hernia will throw considerable doubt on the ability of any apparatus however ingenious to control such a hernia

The inguinal canal belongs to the trunk and a well fitting truss embracing the pelvis will lie secure during all movements and maintain a constant and even pressure on the weak spot The femoral canal is in the thigh and all movements at the hip joint must necessarily displace a pad lying over the saphenous opening and attached to a spring or girdle encircling the trunk. Even were it possible to maintain even pressure by a truss on the crural canal (as it would be for instance in a patient with an ankylosed hip joint) such pressure would be effective only on the fundus of the sac and the distal half of the canal The neck of the sac and the abdominal end of the canal lie behind and above Poupart s ligament where any pressure short of that which would obstruct the femoral vein, is powerless to prevent the entry of abdominal contents into the hernia.

The potential dangers of a femoral hernia are far greater than those of any other type Strangulation is common progresses more rapidly to gangrene and is more fatal in its outcome A truss should never be ordered or allowed even if the patient suggests it except in the unusual case of a wide-mouthed and easily reducible swelling in a patient so old and feeble that an operation even under local anaesthesia is considered unsafe

Umbilical hernia

In the umbilical hernia of infants a belt with a pad or even a home-made retentive apparatus of strapping will normally retain the protrusion and effect a cure by the end of the first year Here the abdominal wall is normal right up to the edge of the orifice there is little subcutaneous fat, and the pad will remain in position over the opening and keep the sac empty

The umbilical herniae of adults are a different problem The whole abdominal wall is sagging the linea alba is stretched the hernial orifice is a somewhat indefinite opening in the fascial layer often multiple and lying beneath a thick layer of fat the sac is lobulated and the contents are usually adherent to it and reducible in part only if at all It is difficult to maintain a pad in the correct position or to apply its pressure to the ring and even if the hernia can be reduced and kept back, it will slip past the pad with any extra exertion or sudden movement of the abdominal wall Because of the liability of these herniae to strangulate and the high mortality of strangulation a truss should be advised only for small and completely reducible swellings in cases where the risk of operative repair is considered prohibitive

Incisional hernia

The efficiency of a belt depends entirely on the size and character of the hernia A wide bulge involving the whole scar can normally be retained by a belt alone or by a belt with a pad over the protrusion It will not increase in size and the belt will allow a fairly normal life and a considerable degree of exertion When on the other hand the sac has a large fundus with a narrow neck passing through a small aperture in rigid scar tissue control by any form of pad is uncertain and strangulation on account of the deficiency in the peritoneal lining and the many adhesions is extremely likely

The place of apparatus in the treatment of hernia

The foregoing remarks may be summed up as follows

1 *A truss should be ordered*

(*a*) As a possible method of cure in all inguinal and most umbilical herniae of infants during the first year of life Operation should be undertaken during this period only for progressive increase in size in spite of conscientious use of the truss by the mother for inability to wear the truss owing to skin soreness or other reasons or for threatened complications

(*b*) To prevent increase in size and avert the risk of strangulation in cases where operation will be undertaken at a later date

In inguinal and umbilical herniae of infants from the end of the first year (after which a cure can no longer be expected) till the earliest suitable age for operation (in my opinion four years for inguinal and two years for umbilical hernia)

In reducible oblique hernia in adults when operation is advised but postponed for social or economic reasons or on account of local or general disease

(*c*) As a safeguard after an emergency or limited operation which cannot be regarded as a radical cure In many operations undertaken for strangulation or in the aged for threatened strangulation, the sac is removed but the measures that would appear necessary to render the hernial opening proof against future yielding have not been carried out because of the condition of the patient In such cases a truss with quite light pressure is usually sufficient to prevent a recurrence

(*d*) As the only possible safeguard in all reducible herniae when operation is out of the question.

2 *A truss may be permitted*

In most direct inguinal herniae and many incisional herniae where the patient is a poor operative risk.

3 *A truss should be discouraged*

In oblique inguinal hernia in a healthy patient

4 *A truss is dangerous*

In femoral hernia in the umbilical herniae of adults in irreducible inguinal herniae and in incisional herniae with a large sac and a small rigid opening

CHAPTER 2

General Principles in the Operative Repair of Hernia

Hernia surgery is highly important but it is not dramatic surgery Some operations save life or restore a sick man to reasonable health and adequate working capacity by recasting the anatomy and function of the parts affected by disease Hernia surgery restores form and function to normal and returns a temporarily incapacitated human being to full health and earning capacity

Hernia operations require no special technique beyond that of good surgery the division of structures by clean cutting the definition of planes without blunt dissection or forcible retraction the avoidance of nerves and major blood vessels meticulous haemostasis and the obliteration of dead space and the approximation of divided structures without tension and without strangulation by sutures of the finest diameter compatible with strength

The basic principles of hernia surgery are simple the removal of the sac to its neck and the closure of the hernial opening at its commencement Of these two demands the second is the more important There may be no sac, the sac may have no neck or it may be so short and wide that removal is unnecessary but, except in certain instances secure closure of the hernial orifice is an indispensable step without which removal of the sac is of no more than temporary value

The chief exception is an oblique inguinal hernia with a congenital sac into which contents have only recently or occasionally descended. In such a hernia there is no hernial orifice in the sense of an abnormal opening The internal inguinal ring is a normal structure that only becomes abnormal when it is stretched In a hernia of the type under discussion it is only the structures passing through the ring that are abnormal There should be vas vessels and nerves only but in such a case there is in addition a thin-walled and collapsed peritoneal tube If this peritoneal sac is removed without trauma all abnormality is removed with it and the inguinal region becomes normal

In all other cases however the opening is an abnormal one which must be securely closed after removal of the sac. The method required for closure will depend upon the size of the opening the nature and strength of the tissues that bound it and the strain to which they are subjected In some cases the tissues in the neighbourhood, drawn tighter by absorbable sutures will provide satisfactory repair In others the closure must be *reinforced* by drawing down adjacent tissues or by turning in flaps from structures in the neighbourhood In others free transplants of living connective tissue from some other part of the body may be used to repair the defect In others again unabsorbable foreign material may be used The principles alone of these different methods can be discussed here, their detailed application must be left to the sections dealing with individual herniae

In most surgical operations catgut is used today for all deep sutures The value of catgut is that it is absorbed when its work is done leaving nothing but living tissues at the site of operation It must be pointed out that the work of catgut indeed of all sutures is one of approximation only No sutures even unabsorbable ones can keep tissues together against a tension tending to separate them for more than a short time In the presence of continued tension, sutures if not absorbed will cut out and the parts will return to their original site unless they are fixed by the permanent agency of living connective tissue Thus there is little value in the stouter sizes of catgut indeed in this material size is little indication of strength In my experience No 0 and even No 00 is usually as strong as No 1, and the sizes above No 1 are often weaker and more unreliable than the finer ones while they cause a greater reaction Kangaroo tendon provides an absorbable suture material of greater strength than catgut While this strength gives it a place in bone surgery its bulk and the insecurity of the knots tied with it make it unsuitable for use in hernia repair Soft tissues should never be subjected to a tension greater than can be exerted by sutures of No 1 catgut

Catgut and kangaroo tendon, though they can be absorbed are not received kindly by tissues Being foreign proteins they provoke a considerable reaction as any surgeon who has been obliged to re-open a wound during the first ten days after suture will have been able to ascertain for himself In the presence of infection they resist absorption and prolong local sepsis till they are discharged.

Sutures of living fascia were introduced by Gallie and le Mesurier

in 1921 These surgeons showed that free transplants of connective tissue could remain alive and keep their structure and strength indefinitely and become united to their surroundings by fibrous tissue However if this connective tissue bond was small in amount or if it was subjected to strain the union between the graft and its bed became stretched By using strips of fascia woven into the receiving tissues instead of patches stitched to them the graft became incorporated into its bed by a living union and displacement was impossible

Gallie sutures are usually taken from the fascia lata on the outer side of the thigh The sutures strips about ¼ in wide and the greatest length that the fascia will allow are removed through an incision about 12 in. long down to the fascia lata the superficial fascia being reflected backwards and forwards for the requisite distance Alternatively strips of fascia may be removed through a small incision at either end of the ilio-tibial band by an instrument designed for the purpose *These fasciatomes are seldom satisfactory* since they are apt to bring out irregular wisps of inadequate length with muscle and fat adhering to them When a number of full-width and full-length sutures are desired, direct exposure is best

The fascial strips are used with special needles with a wide eye (Fig 1) One end of the suture is passed through the eye and tied to itself with fine silk the free end is similarly tied with silk to prevent splitting In taking the first stitch the needle is passed through a portion of the edge of the gap to be closed and then through the terminal end of the suture (Fig 2) In this way a slip knot is produced that forms an excellent anchor The suture is woven strongly into the edge with as many bites as seem necessary and passed backwards and forwards across the opening until its whole length is used up Owing to the slippery character of the fascia it will be found useful to anchor the sutures at every second or third stitch by some form of knot (Fig 2) We usually combine a single loop-knot with transfixion When the first suture has been used up a second may be attached to it in the same way as pieces of tennis gut are fastened together and the sewing continued In this way one suture after another may be inserted until the opening is completely closed. The suture is finally ended by splitting its terminal portion into two strands which are tied together about the suture with a triple knot This knot should be made secure by transfixing it with a catgut ligature which will hold its loops in contact until they become firmly healed together

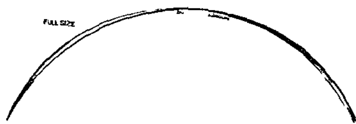




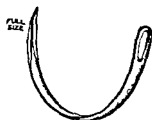
Ogilvie needles No 4 (left) and No 5 (right)



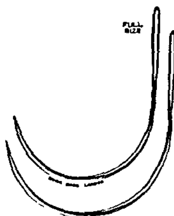
Gallie s needle (small)



Colt s cutting needle



Gallie s needle (large)



Lane s fascial needles

Fig 1 Needles used in hernia surgery

There is of course no particular merit in the fibres of the ilio-tibial band beyond their length and number For limited operations suitable aponeurotic strips may be cut from the tissues in the immediate neighbourhood of the operative field, such as the external oblique aponeurosis When only a single living suture of great strength is required, the plantaris tendon is even better than a fascial strip

In summing up the place of fascial sutures in hernia surgery I can only express a personal opinion based on considerable experience I

think they have had their day as a universal method and they should now be reserved for problems that cannot be met in any other way To the scientifically trained theorist fascial sutures are ideal The material is an autogenous transplant which retains its strength and microscopic structure unimpaired, and which is woven into the tissues and becomes incorporated by living bands into their substance which when so incorporated becomes part of them and so shares their resistance to later infection To the practical surgeon who is forced to admit that even the teachings of experimental animal surgery must be correlated with clinical experience there are disadvantages

Fascial suture adds an operation on the leg to one on the hernia It adds its time and severity and almost prohibits the use of local anaesthesia The thigh incision does not often give trouble but working men sometimes complain of pain and weakness In post-operative infection fascial strips will slough like any other suture material Perhaps the most obvious disadvantage is in the size of the sutures themselves their excessive width and their inadequate length These strips which must be ¼ in. in diameter and the coarse needles required to carry them, make a sorry mess of the delicate structures of the inguinal canal particularly Poupart s ligament which is easily separated thereby into disconnected longitudinal strips They are too short to bridge

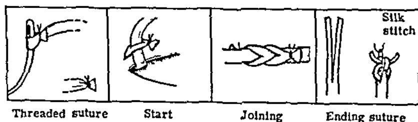




Fig 2 To illustrate the methods of fascial suture

the zone of failure in a large direct hernia which extends from Poupart s ligament to the rectus sheath.

In my own opinion fascial strips are unsuitable for the repair of inguinal hernia Recurrence is frequent and strangulation through a chink in the lattice of tendinous bands is not uncommon. Further the destruction of Poupart s ligament by the sutures makes any further repair very difficult indeed Fascial strips are excellent for the repair of tendons ligaments and the capsules of joints and of traumatic herniae in the abdominal wall and diaphragm whose margins consist of tough scar tissue

Unabsorbable suture material

Because of the mechanical disadvantages of living sutures unabsorbable sutures are being used to an increasing extent today in hernia surgery The materials to be considered are

Mesh materials	*Monofilament materials*
Silk	Silkworm gut
Cotton	Nylon
Linen thread	Wire—silver stainless steel
Braided nylon	tantalum

I would first put forward some general observations on these substances based on my own experience and expressing my personal views

In hernia surgery we must consider suture materials from two points of view Their ability to stimulate a fibroblastic reaction, and their liability to provoke infection

The ability to stimulate a fibroblastic reaction is almost entirely a property of the minute structure of the material All unabsorbable materials are treated by the body *as foreign substances and walled off by fibroblasts The reaction against them is at first violent* and later when the process of encapsulation is complete it is limited to the immediate neighbourhood of the foreign body Monofilament sutures eventually come to be enclosed in a fine avascular connective tissue sheath in which they lie unattached *like a tendon in its sheath.* In this ability to lie unchanged and quiet among the tissues is their value in neuro- and thoracic surgery Mesh suture material is invaded

by the young fibroblasts and a mesh suture is eventually incorporated in and becomes part of the structure into which it has been inserted.

The liability to provoke infection depends largely on the irritant nature of the foreign material In 2 000 000 000 years of evolution the survival of any species has depended on three things on its ability to reproduce in sufficient numbers to keep pace with wastage on its ability to secure food, and on its ability to overcome the attacks of enemies The enemies of the vertebrates have mostly been smaller members of the animal kingdom and the introduction into the tissue of substances of animal origin is resented more than that of vegetable matter Catgut an animal protein provokes a brisk inflammatory reaction which subsides only when the catgut has been broken up and absorbed by the leucocytes summoned to the fight Silk an animal exudate is resented more than cotton or linen which are vegetable fibres

Writing in 1936[1] when I was more influenced by the writings of Halstead than by personal experience I recommended Pearsall's No 4 Chinese twist silk for hernia surgery I said Silk is more pliable and more than twice as strong as catgut of the same diameter silk again is received by the tissues much more kindly than catgut producing no appreciable reaction Should infection supervene silk does not aggravate it but merely prevents the healing of the wound. Once an opening has appeared it settles down to a small sinus with none of the signs of inflammation and through this the silk is quietly and painlessly extruded, having in the meantime done the work for which it was inserted

I have since abandoned silk entirely for all purposes For one thing I have found it highly sinogenic In the Middle East sinuses round silk sutures and knots were so common that I had to forbid its use For another thing I have found Barbour's linen thread superior in every way to silk stronger for a given gauge and in my experience never extruded. Cotton appears to be received as kindly by the tissues as linen, but in comparison it is weak and unreliable material

Monofilament materials have the advantages that their smooth surface does not cause trauma and their solid structure offers no crevices in which bacteria can lodge or into which fibroblasts can penetrate. Of these nylon is the best Silkworm gut is merely monofilament silk, and for that reason is more foreign than nylon, which, being a synthetic

[1] Maingot's *Postgraduate Surgery* Vol. III Part XVIII

fibre is not regarded by the tissues as an enemy from the method of manufacture it is also less uniform in length and diameter, and less reliable in strength than nylon The metal wires have no advantage over nylon They damage gloves fingers and scissors when they are being put in and they fragment after a week or two The one exception is stainless steel wire which because of its strength, is the best material for the emergency resuture of a burst abdomen

Nylon is an ideal suture for the skin, because it causes no sepsis and if sepsis is already present it does not increase it It is unsuitable for hernia repair because though it is a strong material it adds nothing but its own strength to the repaired area It is not incorporated in the tissues it does not provoke a fibroblastic reaction, and if it has been used to displace structures against tension that tension if it persists will re-displace them and leave the nylon behind Re-operation on a failed nylon repair discloses the nylon lying just where it was put in free loops that have no attachment apart from the knots at the beginning and end of the suture line

The worst *material ever used in hernia repair is floss silk which* manages to combine in itself the disadvantages of every other suture material It has the diameter and therefore the disruptive qualities of fascial sutures it has the irritating properties of silk and a loose mesh *structure that makes it a perfect* shelter for bacteria against the attacks of the leucocytes When it causes infection it disintegrates into shreds that take months to extrude themselves and are almost impossible to remove

Materials for filling gaps

There should be no gaps in hernia surgery for the material that filled the hole originally has seldom been destroyed or removed but has merely been pushed aside Nevertheless the temptation to patch rather than to repair is always present The following materials have been used

Sheets of fascia

Any aponeurosis transmitting the pull of a *muscle is strong only* in the direction of that pull Its longitudinal fibres are held together by very few transverse ones and large patches even when they are securely anchored all round are unfitted to take a strain applied *equally to all their margins*

Derma

In the derma the body possesses a connective tissue sheet of tough interlacing fibres equally strong in all directions Many surgeons, of whom Rehn of Freiburg was probably the first have seen the possibilities of derma in repair work The method has failed to secure a permanent place in surgical technique because unfortunately too many surgeons have seen the results in sepsis frequent sinuses and occasional dermoid cysts Sheets of derma however carefully taken always include epithelial remnants sweat and sebaceous glands hair and hair follicles and bacteria and they settle down to make a satisfactory membrane only after the whole of the original transplant has been replaced by the fibroblasts of the neighbourhood

Silver wire filigree

This can be made in any size or strength required and is usually woven by the surgeon himself to fit a particular defect It is easily sterilized and in the absence of infection it is well tolerated by the tissues in time it becomes incorporated in a dense web of fibrous tissue of which it forms the framework. Like all unabsorbable materials silver wire will in the presence of infection, whether present when it was inserted or arriving later by the blood stream keep up the infection indefinitely Whereas silk under such circumstances can be discharged piecemeal through a very small sinus a silver wire filigree can only come out as a whole

In my opinion the perfection of modern methods of hernia repair has left no place for the wire filigree but the surgeons who followed Laurie Macgavin at the Seamen s Hospital are very satisfied with it today Many of their patients carrying double filigrees are carrying out the strenuous work of a merchant seaman over the seven seas of the world

Nylon netting

Nylon woven into an openwork mesh like mosquito netting has been introduced fairly recently and I have no personal experience of its use It can be sterilized by heat and unlike monofilament nylon it should because of its many interstices become incorporated with the tissues

Tantalum wire gauze

Tantalum is a metal that produces no reaction in the tissues Tantalum wire gauze is obtainable in sheets up to 8 in square which can be cut to any shape with scissors bent to any curve and sutured in position with tantalum wire or thread. It soon becomes fragmented by the movements of the body, but the pieces remain in position. (Fig 3)

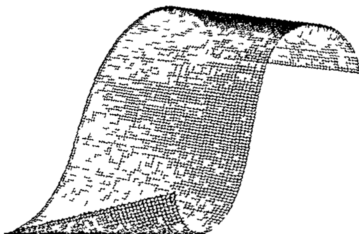


Fig 3 Tantalum gauze

CHAPTER 3

Inguinal Hernia

The inguinal canal

The accounts of the inguinal canal in textbooks are largely traditional They perpetuate the names of long dead worthies and they refer to structures whose appearance in the living does not always tally with the description in the book The conjoined tendon the cremasteric fascia the transversalis fascia when we meet them in the course of an operation, are often very unlike what we have been led to expect What are they and what do they do?

In the inguinal region nature has faced the difficult problem of allowing the emergence from the abdominal cavity without loss of security of the powerful group of flexor muscles of the thigh together with the vessels and nerves of the lower limb The general arrangement of the muscles is similar in all limbed vertebrates In all there are flexors of the thigh that take origin from the vertebral column where it forms the posterior wall of the abdominal cavity In all the abdominal wall consists anteriorly of two rectus muscles running vertically on either side of the mid-line attached below to the pelvic girdle and above to the thorax and laterally of three layers of muscles (some of which may be further divided) running at an angle to each other but on the whole set transversely to the long axis of the body These lateral muscles are attached directly or indirectly to the vertebral column behind, to the thorax above and to the rectus sheath in front Below they end in a firm fibrous band that arches over the psoas and the vessels and nerves to the hind limb and blend with the fascia covering them

We can imagine the ancestral reptile that gave rise to the mammals thus equipped, with an abdominal wall whose lateral muscles the external oblique internal oblique and transversalis all ended below in a common fibrous band that bridged over the flexor muscles and the neurovascular bundle was firmly blended with their sheaths and the septa between them and gained attachment through them to the pubic part of the limb girdle

Then came the mammalian revolution One particular reptilian stock discovered the advantage of being independent of climate and time of year of being able to conduct all the chemical processes of metabolism at a uniform temperature This new method of life demanded fundamental changes of structure More heat must be produced This demanded an increased food intake a better digestive system and increased combustion which in turn involved discarding the nuclei of the red cells to make them pure oxygen carriers sending the blood round more effectively by *means of a four chambered heart* and super-charging the oxygen intake by the more efficient bellows of a diaphragm The increased heat must be conserved by a skin covering that could vary heat retention at will yet could also dissipate heat when, owing to muscular exercise or heated surroundings it threatened to become excessive One function alone refused to be regimented that of reproduction. All creatures tend by migration or by selecting the season to breed under certain conditions of temperature and under these only The newly formed mammals experimenting with living at a much higher temperature than their ancestors had known found it necessary to extrude the male gonads (and possibly the female also at that remote period) from the abdomen into an annexe where they could be maintained at a constant yet lower temperature *than that of the rest of the body*

The inguinal canal is the track of this prehistoric expulsion It is in fact a physiological hernia an extrusion of all the layers of the abdominal wall by the testis as it thrusts its way through. The key to rational hernia surgery therefore lies in an examination of the measures whereby that physiological hernia is kept from becoming pathological and in an attempt to retain that mechanism where possible

The emerging testicle as it passes down the posterior abdominal wall, is brought to a stop by the fibrous barrier of the arch spanning the psoas and the neurovascular bundle and it is forced to traverse the lateral abdominal muscles just above this arch (Fig 4) The layers it pushes in front of it are fibrous and muscular *The first is the transversalis* layer which is here a tough fibrous sheet named by anatomists the transversalis fascia or fascia of Astley Cooper for he first pointed out its significance Elsewhere thin, this fascia is a tough sheet where it forms the posterior wall of the inguinal canal It seems clear however that here it is not merely an investing membrane as is the rest of the so-called transversalis *fascia, but that it represents* the tendon of

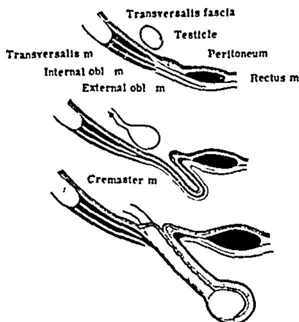


FIG 4 The eruption of the testis

insertion of the transversalis muscle into the fibrous arch common to the lateral muscle group This transversalis layer transmits the cord through an opening with almost tendinous margins whose edges are prolonged upwards as fan-like extensions on the deep aspect of the muscular fibres of the transversalis (Fig 5) It is carried on the cord as a thin investing layer the infundibuliform fascia The remainder of the transversalis layer making the posterior wall of the canal is thickened where it blends with Poupart s Ligament

The muscular layers consist of the lower edges of the internal oblique and transversalis which are separate where they arise from Poupart s ligament and blended where they are inserted as the conjoined tendon into the pubis and of the cremaster muscle which represents their extruded lower fibres and springs from the whole ring through which the testicle emerged and which then wraps round the cord and extends in loops to surround the testicle itself (Fig 6) These muscular layers are really one The internal oblique and the transversalis muscles thrust aside by the bow-wave of this biological

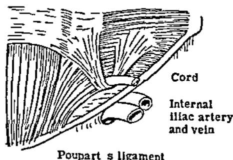


FIG 5 Schema of the internal ring from behind (after Lytle)

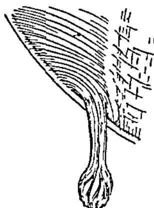


FIG 6 The conjoined and cremaster muscles

projectile are fused to form the so-called conjoined tendon The same muscles where they lie directly in the track are thinned out and curved downwards their fibres being spread all round the testis and cord There is no boundary where the conjoined tendon ends and the cremaster begins There is no cremasteric fascia The cremaster in a healthy man is a muscular sheet ⅛ in thick an integral part of the inguinal mechanism The posterior wall of the inguinal canal consists of the thinned tendon of the transversalis muscle covered by the posterior fibres of the cremaster muscle

The most external layer the aponeurosis of the external oblique is pierced near its insertion by the cord the main fibres being thrust aside to form the pillars of the external ring but some continuing over the cord as a thin investing layer Poupart s ligament which is conveniently described as the upturned lower edge of the external oblique aponeurosis is really the representative of the fibrous arch that bridges the flexor muscles in reptiles and amphibia It contains contributions from all the lateral abdominal muscles and from the fascia over the iliacus and is continued into the fascia lining the pelvis and the fascia lata of the thigh.

The gap between the pillars of the ring is usually visible right up to the muscular part of the external oblique which extends horizontally inwards from the anterior superior spine This gap is bridged by weak transverse fibres but it is widened by the presence of a hernia in the canal For this reason methods of approach to the inguinal canal that make a point of leaving the external ring untouched are unsound

Opening of the ring by dividing the intercolumnar fibres and extending the cut in the aponeurotic gap is necessary not only for atraumatic reflection of the cremaster afterwards but also to allow the stretched ring to be sutured back to its normal size

Medially the external oblique aponeurosis joins the anterior rectus sheath but it does so a full inch inside the lateral border of the rectus muscle so that for this width the sheath is formed by contributions of the internal oblique and transversalis only

These anatomical points are all of importance when we come to consider the normal defences of the inguinal canal and the principles of repair when they become effete Any subdivision of the posterior wall is valueless and Hesselbach s triangle should be one of the first pieces of useless verbiage to be scrapped Such redundant descriptions do more than overload the student s memory they suggest that the inguinal canal is a mechanical defence mechanism whose security depends upon fibrous planes an oblique course and two openings placed some distance from each other in short upon a valvular mechanism. The valve is a device not employed in the body except in the circulatory system There is no cardiac valve no pyloric valve no ilio-caecal valve and no ureteric valve

Studied by the anatomy of the living the observation of structures when they are working the inguinal canal is seen to be a muscular sphincter The inguinal muscles work with the abdominal musculature of which they form a part and whose innervation they share When the abdominal pressure is raised tending to force the cord farther out of the abdomen or a pouch of peritoneum beside it the external oblique aponeurosis becomes a rigid sheet supporting the deeper layers and fixing the rectus sheath The cremaster pulls the testicle and cord up against the extruding force and towards the internal ring (As can be seen in any young boy when he is asked to cough) The conjoined muscles straighten out the arch of their lower fibres interposing a thick muscular band that prevents the fibrous posterior wall from bulging The transversalis muscle as it contracts pulls the internal ring with the enclosed cord upwards and outwards behind the muscular sheet

The mechanisms that defend the inguinal canal against abdominal pressure are thus muscular rather than fibrous (Fig 7) When they are healthy the cord with its abundant and varying blood supply can pass through undamaged but nothing else can pass beside it

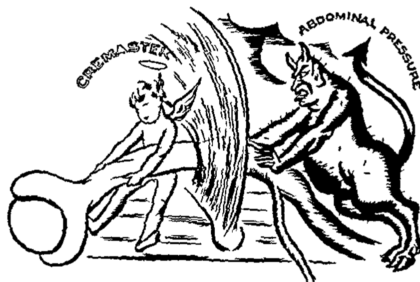


Fig 7 A cartoon by Anna Zinkeisen emphasizing the fact that the defences of the inguinal canal against intra abdominal pressure are muscular rather than fibrous

Types of inguinal hernia

There are two main types of inguinal hernia the *oblique or indirect* and the *direct* In oblique inguinal hernia the hernial opening is lateral to the deep epigastric artery in direct hernia the opening is medial to the artery Both indirect and direct herniae may be congenital or acquired but whereas the great majority of oblique herniae are congenital all except a very few direct herniae are acquired (Fig 8)

The oblique hernia accompanies the cord. It has the same fascial covering and is led by it along the inguinal canal through the external abdominal ring into the scrotum, and finally to the testis–The direct hernia pushes through the abdominal wall behind and not in any particular relationship to the cord, which is merely an anterior relation and may lie above it below it or over its summit It has thus the same intercolumnar and cremasteric coverings as an oblique hernia but not the fascial layer while in addition it is covered by the layers of the abdominal wall that lie behind the cord. As it enlarges its spread is limited by the attachment of these layers to Poupart s ligament and the iliopectineal line Being a bulging of the posterior wall of the inguinal canal it will continue to bulge it in a centrifugal manner being limited

only by the relative strength of the structures it encounters Poupart's ligament and the outer border of the rectus muscle near its insertion, here reinforced by the pyramidalis are almost unyielding so that an enlarging direct hernia tends to push upwards and outwards eventually stretching the muscles far beyond the confines of the inguinal canal but hardly ever entering the scrotum. The zone of failure in the inguinal canal is thus a V with the body of the pubis as its apex and Poupart's ligament and the rectus sheath as its limbs (Fig. 9)

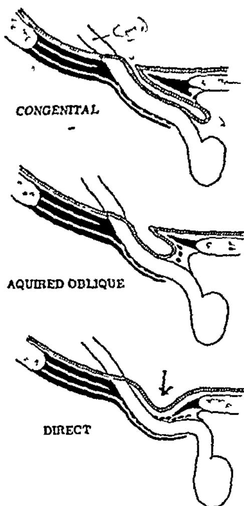


FIG 8 Types of inguinal hernia

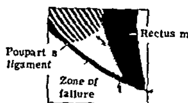


FIG 9

Congenital oblique inguinal hernia

The testis is formed in the lumbar region. At the third month the Wolffian duct (that will form the epididymis) and the genital gland (that will form the corpus testis) project into the coelomic cavity on separate mesenteries with a common attachment. During the fourth to the sixth month they slide down the posterior abdominal wall, while the epididymis is formed The two mesenteries become

blended as the mesorchium and the testis assumes its final shape By the seventh month it reaches the internal ring Meanwhile there is a rapid growth of muscular tissue in the mesorchium This muscular mass the gubernaculum pushes its way into the scrotum in advance of the testes, carrying with it all layers of the abdominal wall the peritoneum the transversalis fascia the internal oblique and transversalis muscular layers the external oblique layer and the deep layer of the superficial fascia of the groin During the seventh month the testis also passes through the abdominal wall sliding down the back of the peritoneal tube dragged from the iliac fossa by the gubernaculum In the eighth month it lies at the external ring At birth it has reached the bottom of the scrotum

A congenital oblique hernia

The common kind is due to persistence in whole or in part of the funicular process the evagination of the peritoneum that preceded the testis in its descent The disposition of the sac may follow one of four types the vaginal the funicular the retrofunicular or the intra-funicular (Fig 10)

The vaginal type of sac often named the congenital is clearly a persistence of the whole funicular process including that part which normally remains as the tunica vaginalis The funicular type is almost as certainly due to the persistence of the upper part of the process with obliteration of the lumen at the upper pole of the testis where the sac does not go right down into the scrotum the obliterated segment can usually be traced as a fibrous band uniting the fundus of the sac to the summit of the tunica vaginalis

The retro-funicular and intra-funicular herniae grouped together under the term infantile are of more uncertain origin. The explanation that is usually given in textbooks and almost certainly the wrong one is that the funicular process is closed at the internal ring remaining patent distally and that an acquired sac is later pushed down in front of it behind it or into its lumen Every stage intermediate between the funicular and retrofunicular varieties is met with the tunica vaginalis extending up into the inguinal canal for varying distances in front of the sac so that it seems probable that the infantile varieties are due to irregularities in the descent or obliteration of the funicular process and have no acquired element The distinction is of academic interest only and affects neither the diagnosis nor the treatment of

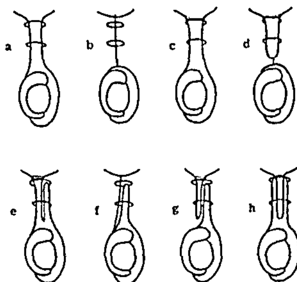


FIG 10 Developmental abnormalities arising in the funicular process

a The funicular process just before birth
b Normal closure of the funicular process
c Congenital hernia persistence of the condition seen in *a*
d Funicular hernia
e Hernia magna
f Bilocular hydrocele
g Retro-funicular hernia
h Intro-funicular hernia

these herniae Only the possible confusion of an inexperienced surgeon on finding two cavities where he expected to find one justifies this discussion.

The sac of a congenital hernia lies in front of the cord or rather surrounds it in front above and below so that in transverse section it shows as a horse-shoe shaped slit into which the cord is invaginated much as the testis appears to be pushed into the tunica vaginalis The sac is intimately bound to the structures of the cord, particularly to the vas deferens from which it can be separated only with difficulty In herniae associated with imperfectly descended testes the peritoneum is so thin and the sheathing of the cord by the sac so intimate that the separation and closure of the peritoneal process is a matter of real difficulty The sac bears further traces of its congential origin in numerous

bands of fibrous muscular and nerve tissue which streak its outer surface and in the presence of small rests of adrenal cortex in its walls

In most cases the process of peritoneum forming the sac is a simple tube Occasionally the distal part is divided by septa into a series of compartments which may be distended with fluid Incomplete septa and diverticula from the main channel are also found These irregularities are probably of developmental origin, but some of them may be the result of pressure by a truss

The extra-peritoneal fat usually ceases at the internal ring and in the operation for hernia its appearance is usually an indication that the ring has been reached The fat may however invade the cord particularly in the inguinal canal of adults Two conditions are seen In one the fat extends down the cord, distinct from the vessels and sac but in the same fascial envelope as a lobular finger-like process carrying an obvious blood vessel with it The appearance suggests that the fat had descended with and at the same time as the testis In the other type the fat is invaginated into the neck of the sac and bears when viewed from the inside of the cavity a very striking resemblance to a loop of small intestine protruding through the opening

An acquired oblique hernia

This is far more common than the textbooks admit Most sliding herniae are of this nature

When a normal inguinal canal is laid open in the dissecting room or during life as in the operation for the radical cure of femoral hernia by the inguinal route it will be found that a moderate pull on the cord brings down a rounded pouch of parietal peritoneum through the opening in the transversalis fascia An acquired oblique hernia probably has its origin in such a prolapse of the cord, due to the combined influence of poor muscles and repeated straining The diverticulum once formed, is further stretched by efforts of straining or coughing and becomes a fully developed hernia

The acquired origin of any oblique hernia can never be proved beyond doubt but it is typical of such a hernia that the sac is immediately visible among the other structures of the cord, that it is thick walled and broad in proportion to its length that its fundus is rounded and not continued by any fibrous bands into the scrotum that its walls are distinct and separable without dissection from the vas and pampiniform plexus and that its neck is wide and surrounds the emerging cord

on all sides except the inferior instead of lying lateral to it as does the neck of a congenital sac.

Direct hernia

A direct hernia is merely a bulging of the posterior wall of the inguinal canal Anatomy books have in the past described this part as Hesselbach s triangle a triangle bounded by Poupart s ligament below the deep epigastric artery laterally and the outer border of the rectus muscle medially and further have subdivided this triangle into outer and inner portions marked by the obliterated hypogastric artery Such names are meaningless and such subdivisions are without significance They are best forgotten. The portion which yields first is that which is formed by the transversalis fascia alone that is the part medial to the deep epigastric artery below the arched fibres of the conjoined muscle and lateral to their insertion into the ilio-pectineal line The bulge is a general one roughly hemispherical in shape and the sac which hardly merits such a name has no neck. It is covered by fascia throughout.

As the hernia enlarges it spreads upwards and outwards The epigastric artery becomes stretched over it and in a large hernia may appear to divide the swelling into two lobes The lower fibres of the conjoined muscle and cremaster become stretched and their fibres separated. The external oblique aponeurosis becomes thinned. A direct hernia does not come through the external ring in the sense that an indirect one does but as it increases in size it meets with less resistance in the intercolumnar fibres than in the more fully developed parts of the aponeurosis that lie laterally and it may bulge through the stretched external ring Such a hernia shows the most prominent swelling and gives the most obvious impulse on coughing at the external ring but it does not like the indirect hernia become inguino-scrotal

The sac of any inguinal hernia, as it enlarges tends to drag down further peritoneum from that lining the abdominal parieties and with it any intra-abdominal mobile structures which the peritoneum clothes Thus the bladder may be drawn into the neck of the sac on the inner side the caecum into the posterior wall of a right hernia and the iliac colon into a left one

A congenital direct hernia

A case was described by me in 1935 and occasional examples have since been reported by other surgeons

The opening is in the conjoined tendon just lateral to where it is inserted into the sheath of rectus and pyramidalis a part that is really tendinous (Fig 11) The orifice is rigid, circular and usually small—from ¼ to ½ in. in diameter The sac is long narrow and tubular It does not accompany the cord but may extend through the external ring There is no general yielding of the posterior wall of the canal

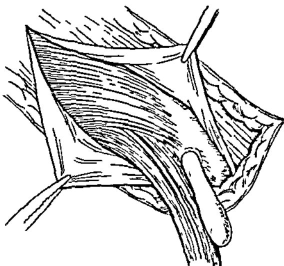


Fig 11 Congenital direct hernia

It is difficult to explain the origin of these uncommon herniae but they are probably due to some aberrant gubernacular mechanism The long tubular sac and the small rigid opening suggest a traction diverticulum rather than one due to pulsion

The diagnosis of inguinal hernia

Inspection is important for a small hernia can often be better seen than felt This is particularly true of a bubonocele in women and small children, in whom the overlying fat often obscures the impulse on coughing in a small sac Inspection too is often the most certain means of distinguishing between the common condition of bulging groin seen in feeble and sedentary men and a definite hernia.

The distinction between an oblique and a direct hernia is often difficult and sometimes impossible It is unimportant, for the type of

large wide-mouthed hernia in which differentiation is hard usually needs an operation involving reconstruction of the inguinal canal and the exact relations of the swelling will become apparent when the tissues are exposed.

Direct herniae are usually seen in men over forty they are bilateral and symmetrical in size and position A hernia which appears as soon as the patient stands without any straining effort and which disappears as soon as he lies down without the application of any pressure or one which when reduced reappears immediately is probably direct One whose length exceeds its breadth which comes anywhere below Poupart s ligament or medial to the pubic spine or one which when it is made to reappear by coughing is seen to fill obliquely rather than to come straight forward is probably oblique

The differential diagnosis between inguinal hernia and other inguino-scrotal swellings is seldom difficult Common sense should serve to distinguish swellings that are superficial to the abdominal wall such as an abscess or swelling of the inguinal lymph nodes and those deep to it lying in the psoas of iliac vessels from swellings in the inguinal canal proper Swellings in the inguinal canal must arise from some structure in the spermatic cord and are either tumours—lipoma or fibroma—or varicoceles or abnormalities in the mechanism of testicular descent—retained testes or hydroceles of the cord A lipoma is softer than a hernia and gives no impulse on coughing but unless accompanied by a sac, it rarely attains sufficient size or gives enough trouble to attract the attention of the patient A fibroma is a firm rounded swelling which can be distinguished with certainty from an encysted hydrocele only by the absence of translucency A varicocele can never be mistaken for anything else unless one of the varices has ruptured

An encysted hydrocele of the cord is often diagnosed but seldom seen after puberty A true encysted hydrocele is a small rounded translucent swelling sharply demarcated above and below The majority of rounded translucent swellings seen in the inguinal canal of adults are encysted hydroceles of a hernial sac, the neck of which is blocked by a plug of omentum Their true nature is revealed by examination of the neighbourhood of the internal ring when the cord will be found to be thickened

CHAPTER 4

General Principles in Operations on the Inguinal Canal

The incision

The skin in the inguinal region is smooth over the outer part, hairy towards the pubis and at the level of the pubic spine it has the rugose surface and the large sebaceous glands of the scrotum and labium majus The superficial fascia shows the two layers fatty and fibrous of Camper and Scarpa The latter which is continued into the scrotum and labium and is attached just below Poupart s ligament to the fascia lata of the thigh must be divided with the knife before the femoral opening can be explored through an inguinal incision

The standard incision for the operation for the repair of inguinal hernia is an inch above and parallel to Poupart s ligament This incision has the advantage of direct access and for that reason it may be preferred by the surgeon working short handed but it is not a good one It leaves a scar that is always obvious sometimes keloid and occasionally painful These drawbacks are due in part to the encroachment of the incision at its lower end on skin that is sterilized with difficulty in part to its lying across lines of tension

The position of rest of the trunk is with the lumbar spine and the hips flexed. To this position the skin adapts itself and flexion of the trunk and thighs leaves a constant crease in the inguinal region shown in Albrecht Durer s drawings and known by the older anatomists as the line of Venus (Fig 12) This line crosses the midline about 1½ in. above the pubis and on each

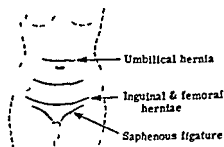


FIG 12 The flexion creases in the abdominal wall and their uses in hernia surgery

side it curves upwards as it passes outwards crossing the line of Poupart s ligament in its outer fourth and fading away on the outer side of the thigh just below the anterior superior spine This crease is the best site for an incision for inguinal or femoral hernia It is a line of skin rest and the stitches can safely be removed in four or five days The scar is comfortable and almost invisible and it leaves very little scar tissue in the subcutaneous layers so that further operation in the same region should it be required later is easy In children it has the further advantage that it removes the stitches and dressings a further ¾ in from the area of probable soiling

Local anaesthesia for operations on the inguinal canal

Operations for inguinal hernia must often be undertaken urgently in patients whose age or general condition would prohibit such a step were it not for the even greater danger of some threatened complication The risks are largely eliminated by the use of local anaesthesia

Modern local anaesthesia depends on blocking main nerve trunks outside the area of the proposed operation rather than on infiltration of the tissues in that area The nerves that must be blocked for an operation on the inguinal canal are many The skin of the groin is supplied by branches of the 12th dorsal 1st lumbar lateral cutaneous and genito-crural nerves The skin of the scrotum is supplied by the ilio-inguinal nerve by scrotal branches from the internal pudic and by the long pudendal nerve from the small sciatic The abdominal muscles and peritoneum are innervated by the ilio-inguinal and ilio-hypogastric nerves The cord and testis receive their sensation from the spermatic nerves accompanying the vessels in the cord These nerves can all be reached through three subcutaneous wheals one a finger s breadth medial to the anterior superior spine one over the saphenous opening and one over the supra-pubic skin crease in the mid line (Fig 13) The secret of successful local anaesthesia is twofold firstly the administration of sufficient sedative an hour before the operation to render the patient drowsy during its performance and secondly a pause of at least fifteen minutes between the injection of the anaesthetic and the start of the operation.

The solution recommended is one of ½ per cent xylocaine to which one drop of 1/000 adrenalin solution to every 10 c c has been added. The three subcutaneous wheals are first raised with a fine hypodermic needle A 3½ in. needle is used for the remaining injections

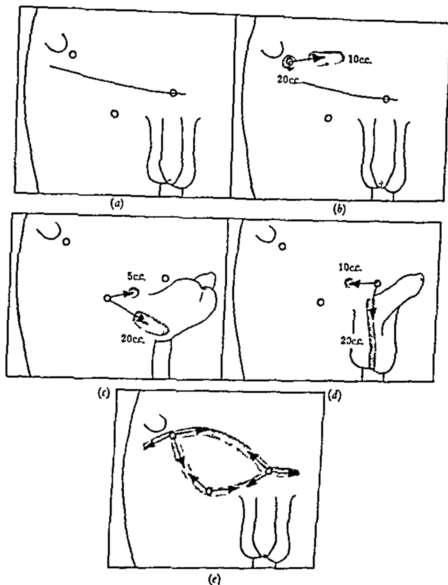


Fig 13 Local anaesthesia for inguinal hernia (see text)

a The cutaneous wheals *b* Deep injections through the first wheal *c* Deep injections through the second wheal *d* Deep injections through the third wheal *e* Circum-injection in the subcutaneous layer through all three wheals

The needle is first inserted through the first wheal (that just medial to the anterior superior spine) at right angles to the skin and pushed slowly down till its point strikes the bone of the iliac fossa (Fig 13b) 20 c.c. of solution is then injected slowly into the muscle to block the ilio-inguinal ilio-hypogastric and last dorsal nerves The needle is then withdrawn from the muscular layer and pushed again through the external oblique aponeurosis about 1½ in medial to the anterior superior spine and a further 10 c c of solution is injected between the aponeurosis and the internal oblique layer in a direction horizontally inwards

The needle is next inserted through the second wheal (that over the saphenous opening) and 20 c c of solution are injected horizontally across the base of the scrotum which is held up in order to block the scrotal nerves (Fig 13c) Withdrawn slightly its point is then pushed upwards and inwards till it strikes the pubic spine and 5 c.c of solution are injected there

Through the third wheal (that is the mid-line) a plane of solution (20 c c in all) is laid down in the mid plane of the scrotum by passing the needle *round the root of the penis into the upper part of the* scrotum (injecting as it is advanced) and then feeding the tissues in the mid-line of the scrotum on to the point of the needle in turn (Fig 13d) Still using the same wheal 10 c c of solution are injected into the fascial envelope of the cord which is held up at the external ring for this purpose

Lastly using all three wheals a continuous line of subcutaneous injection, using about 40 c c. in all is placed around the whole area uniting all three wheals and a further line along the skin crease which will be used for the incision If the surgeon completes the injections before he puts on his gown and gloves for the operation, anaesthesia should be complete by the time he is ready to start

General principles of operation upon inguinal hernia

What is the operative treatment of inguinal hernia? It is only necessary to put the question in this way to raise a laugh The operations that have been advised and practised are legion. Each is somebody s darling and I have not the temerity to criticise or select from among them I shall therefore give my own views the operations that I have now practised for twenty years and have found successful In a later chapter I shall give the outline of other operations that have been

widely recommended and my reasons for avoiding them or abandoning them

Two general statements will I think be accepted by all First that permanent cures can be obtained by operation even in large and old standing herniae provided that the patient is fit enough to allow an operation appropriate to his particular defect to be done Cures should therefore be all the more certain in the simple cases A cure rate of 100 per cent should be obtainable provided that an operation of the correct type has been done, and well done The inguinal canal is the recognized practice ground for the man who likes to do a spot of surgery just as he likes to play a spot of golf!

Secondly in any particular group of patients submitted to similar operations the proportion of cures varies with the type of hernia The following results may be looked upon as average or a little better than average

1 Inguinal hernia in childhood and oblique inguinal hernia of recent *appearance in healthy young adults* *100 per cent*
2 Oblique inguinal hernia in older patients when the history is short and *the inguinal canal apparently sound* *95 per cent*
3 Old oblique herniae and direct herniae 90 per cent

It is said that sepsis is the commonest cause of recurrence This does not agree with the lessons of experience Sepsis enforces a long rest and it calls forth an abundant reaction of repair Induced sepsis was the basis of the medieval cure of hernia by blistering and an inflammatory reaction is the probable modus operandi of the injection treatment and of the insertion of dermal transplants Could sepsis be regulated it would be the reparative surgeon s best friend In any case it is common experience that a majority of recurrences are found under beautiful linear scars

The usual cause of recurrence is that the first operation has been done by the wrong surgeon or by the wrong method. *During the* Second World War recurrence after hernia operations in healthy young men was a major *headache both in the Army and in the Air* Force The following excerpt is from a memorandum circulated by the department of statistical research of the Army Medical Services ' The overwhelming majority of such recurring cases are the result of an operation *for the performance* of which a relatively modest level of professional skill is deemed to suffice

Hernia operations are rarely considered important They are lightly undertaken by men who are not surgeons at all and who refrain from attempting any other abdominal procedures In hospitals they are often regarded as introductory exercises for the novice and are left by the chief to his assistant when he has finished the more interesting part of his list

The three groups outlined above with their varying prospects of cure correspond very approximately to three degrees of pathological change demanding in each case an operation of a different type In the first the inguinal canal is normal for an unfilled hernial sac is a potential space only In the second the internal ring has become dilated that is the fibrous defences have been weakened but the muscular defences are intact In the third the posterior wall has given way and the muscles have also become weak, that is the inguinal mechanism has failed.

In the first group removal of the sac will remove the only abnormality and, provided that it has been accomplished without damage to the internal ring or the muscles this simple operation will lead to lasting cure In the second group the muscles cannot be expected to maintain the integrity of the canal unless the stretched internal ring has been restored to its original size and strength In the third group the failed inguinal canal must be reconstructed

I THE STANDARD OPERATION

(a) The skin incision

After identification of the skin crease three or four lines are marked across it with a pen, brush or throat swab dipped in Bonney s blue to ensure accurate spacing of the flaps when they are subsequently sutured (Fig 14) The cut made with a continuous sweep of the knife while the skin is put on the stretch with the finger and thumb of the left hand extends in the crease from the front where it crosses Poupart s ligament nearly to the midline Two or three branches of the superficial femoral vessels which are seen running in the fatty layer at right angles to the incision are divided between artery forceps and ligatured with No 90 linen thread. The incision is then deepened down to the external oblique The surgeon then grasps the whole thickness of the lower flap with toothed dissecting forceps and lifts

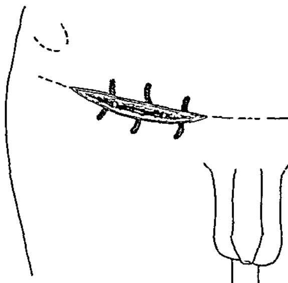


FIG 14 Standard operation for inguinal hernia The incision

it away from the abdominal wall while the assistant does the same with the upper flap A few bold sweeps with the knife in the areolar plane between Colles fascia and the external oblique aponeurosis followed by gentle pressure with a swab will separate the fatty layers from the aponeurosis upwards and outwards as far as the muscular

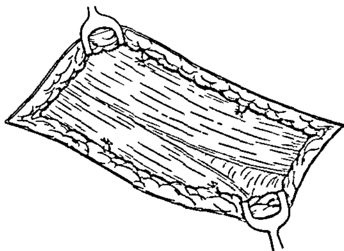


FIG 15 Standard operation Reflection of the superficial flaps

fibres downwards as far as Poupart's ligament and inwards to the external ring and the emerging cord (Fig 15) Poupart's ligament should be laid bare at this stage down to its insertion in order to facilitate subsequent suture of the pillars

(b) **Reflection of the external oblique aponeurosis**

The external oblique should be incised towards the external ring and not from it as this method carries a risk of injury to the cremaster muscle or the ilio-inguinal nerve A cut ½ in. long is made with a knife in the line of the pillars and about ¾ in from the point where they diverge The upper leaf is held up with dissecting forceps and the cut is extended with Mayo scissors into the external ring and carefully beyond it into the inter-columnar fascia The cut is then extended outwards in the line of the fibres to a point 1 in lateral to the internal ring

The upper leaf is then reflected off the underlying structures which are gently detached from its deep surface with sweeping strokes of the closed Mayo scissors working from without inwards in the line of the arched fibres of the internal oblique Separation is continued till the outer border of the rectus sheath is exposed (Fig 16)

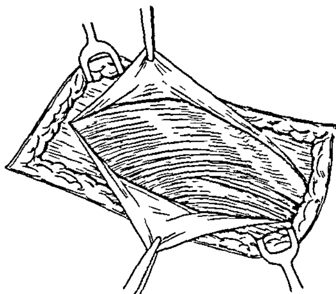


Fig 16 Standard operation Reflection of the cremaster muscle from the cord

The lower leaf is treated in a similar manner till the inner surface of Poupart s ligament is cleared as far as its insertion into the pubic bone The fibres of the cremaster will be separated from the deep surface of the aponeurosis with which they lie in contact, but their origin from Poupart s ligament must on no account be disturbed.

When this stage is complete the cord will be seen completely clothed in the fibres of the cremaster muscle on whose surface lies the ilio-inguinal nerve

(c) Opening the sub-cremasteric space

The surgeon picks up the cremaster muscle $\frac{1}{8}$ in below the ilio-inguinal nerve directs his assistant to do the same just below it and divides it boldly in the line of its fibres downwards to the centre of the external ring and upwards to within $\frac{1}{2}$ in of the point where the thickened arching fibres indicate the lower end of the internal oblique *He now releases the lower leaf of the cremaster and picking up the* cord with toothed forceps he frees it by a few gentle touches of the closed Mayo scissors from the upper leaf of the muscle which is still held by his assistant (Fig 17) The assistant then releases this leaf and takes the cord from the surgeon who picks up the lower muscular sheet and frees it in a similar manner The cord is now free and can be

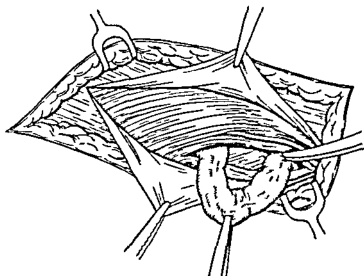


FIG 17 Opening of the sub-cremasteric space and isolation of the cord in its fascial sheath

hooked up on the forefinger of the left hand while the cremaster at its two extremities is pushed off it with a gauze swab The cord lying on the finger is covered with infundibuliform fascia only through which all its constituents normal or abnormal can be clearly seen

(d) Isolation and ligature of the hernial sac

The cord still lying on the index finger of the left hand is incised longitudinally for about 1½ in by a gentle stroke of the knife that divides the investing fascia only The sac, which has already been seen lying anteriorly now prolapses through this cut completely denuded on its superficial aspect It is picked up with a pair of haemostats which are then fixed by the thumb of the left hand and is thus held firmly on the pulp of the left index finger

With a pair of non-toothed dissecting forceps all structures adhering to the sac are gently separated from it working transversely to its long axis (Fig 18) As succeeding parts of the sac are laid bare they are gathered up with the left thumb bringing a fresh portion into view for clearance Finally the point of commencement is reached and the index finger will be seen in a space that separates the sac from the cord

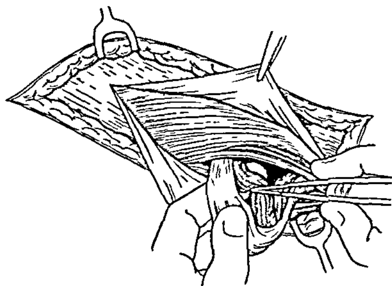


Fig 18 Isolation of the sac from the cord bundle

If the plane of dissection has been kept close to the wall of the sac there is no danger of injury to the vas but the surgeon should always assure himself at this stage by feeling the separated cord, that the vas is actually with the vessels and not with the sac This dissection, once begun, must be pursued methodically in a plane transverse to the axis of the cord till two separate bundles emerge the sac on one hand and the normal constituents of the cord on the other The left thumb must not relax its grip on the sac and the temptation to wander up or down the cord must be resisted.

The structures of the cord are kept together by enclosing them in the loop of a Lane s tissue forceps, and the separation of the sac is continued towards the fundus The sac is spread out and fixed by the left hand, while the structures of the cord are peeled off it with blunt dissecting forceps This separation may be difficult at the fundus The tunica vaginalis is often adherent over a wide area to the expanded fundus of the sac The veins increasing in size as the testicle is reached may also be adherent to it, and the vas may lie in a loop on its walls Many of the bands are so tough that they must be cut with the knife By holding the cord on the stretch and pushing its constituents off the sac with a gauze swab or closed scissors and by using the knife only for strands that stand out between structures already isolated the separation can be effected cleanly and bloodlessly

When the fundus is free the surgeon gets his assistant to put the cord on the stretch by drawing it downwards and inwards while he clears the neck of the sac The fascial sheath which in an unstretched inguinal canal is almost tendinous at the internal ring must be treated with great respect for on its integrity the success of the operation depends When well marked it may be separated from the peritoneum of the sac by a circular cut with a knife or snipped with scissors close to the sac It must not be torn apart In an undilated sac the site of the neck can be recognized easily by a sudden expansion in diameter where it becomes the thin parietal peritoneum by a tongue of extra-peritoneal fat that appears beside it and by the deep epigastric vessels on its inner side

Except in those sacs thin enough for the contents to be seen through them the fundus should now be cut and held open with three haemostats The interior of the sac is inspected any abdominal contents still in it are returned and a blunt instrument is passed into the peritoneal cavity to prove that no contents are adherent at the neck. The fundus

is then grasped in a haemostat and twisted till the turns reach the internal ring (Fig 19) This manœuvre insures that no loop of gut or tag of omentum can re-enter the sac at the last moment and be pierced during transfixion of the sac and it provides a narrow pedicle for ligature

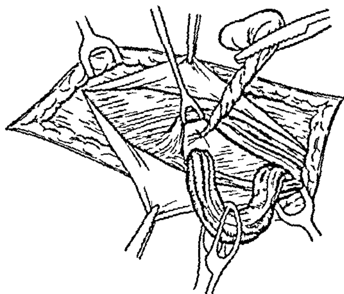


FIG 19 Standard operation Ligature of the sac at its neck

The sac is held up while the twisted neck is pierced by a round needle carrying No 1 catgut and tied first on one side then on the other and finally all round in the groove made by the first two knots The ligature is cut and the sac is divided ½ in beyond it The stump recedes into the aperture in the transversalis fascia and disappears from view

(e) Repair of the inguinal canal and closure of the wound

If the internal ring has not been stretched by the hernia or damaged during the dissection, and then only the layers are closed in sequence

The cord is pushed down into the scrotum till it lies level with the floor of the canal The cut edges of the cremaster are picked up near the internal ring and united with a continuous suture of 00 catgut (Fig 20) The muscle fibres have not been cut across so that only the lightest

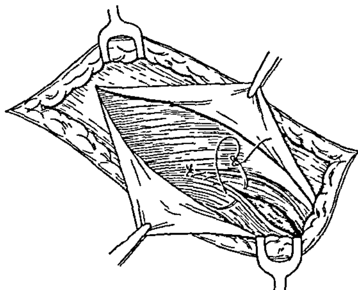


FIG 20 Standard operation Repair of the cremaster muscle

tension is needed to approximate the edges Care must be taken that the ilio-inguinal nerve is not caught up

The external oblique aponeurosis is sutured with No 1 catgut starting at the lateral end of the wound (Fig 21) As the medial end is approached it is important to make sure that each stitch takes a firm bite of the pillars of the ring and not merely of the thin inter-columnar fascia The suture should be continued medially till the ring is reduced to a size that will just transmit the cord—that is to the diameter of the last joint of the little finger The last stitch should be held tight and the diameter of the ring should be tested before it is tied.

Accurate closure of the subcutaneous as well as of the cutaneous layers of the incision is an important step in the crease incision for hernia Four or five sutures of very fine nylon on a Colt s cutting needle are passed in the following way The needle is entered ¼ in. outside the wound edge and passed vertically through the superficial fascia to appear in the plane between Campers fascia and the external oblique it is then passed outwards through the same layers on the other side to emerge at a similar distance from the wound edge (Fig 22) The sutures are placed at even distances guided by the blue marks on the skin and their ends are held in haemostats. The skin edges are then joined by Michel clips placed closely the blue lines on

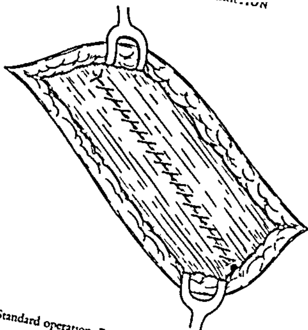


FIG 21 Standard operation Repair of external oblique aponeurosis

opposite sides being matched exactly Finally the nylon sutures are tied over a cylinder of gauze 1 in in diameter taking the tension off the skin edges and preventing any oozing in the deeper layers A single layer of gauze is laid over the pressure dressing to keep the strapping from adhering to the stitches and the dressing is fixed with a length of porous Elastikon strapping

(f) After treatment

A crease incision lies in a plane of no movement and clips and sutures are no more than approximating devices The stitches should be removed on the third day but the gauze cylinder that they held should be left in position till the fifth day when the clips should be removed

I formerly advised three weeks recumbency after a hernia operation I now advise early movement Ambulation on the first day is foolish but free movement in bed should be encouraged as soon as the patient is round from the anaesthetic (which with a good anaesthetist is as soon as he gets back to bed) On the second day he should be encouraged, but not driven to get out of bed and he should be allowed

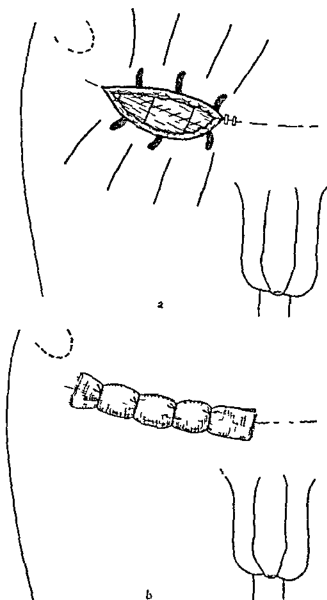


Fig -- Standard operation Closure of the skin incision

(*a*) Nylon anchor sutures inserted Approximation by Michel clips has been started
(*b*) Nylon sutures tied over gauze roll

to do more each day Harmful strain of recently divided tissues is prevented by reflex inhibition The only strains likely to damage a hernia repair are those of coughing and constipation, and both are more likely in a bed-confined than in an ambulant patient

(g) Special points in the isolation and ligature of the hernial sac

(i) *The separation of a very thin walled sac* In some inguinal herniae particularly the congenital herniae of children that extend into the tunica vaginalis and those associated with non-descent of the testes the walls of the sac are very thin and adherent to an unusual degree to the structures of the cord. In spite of the greatest gentleness the peritoneum is often torn when an attempt is made to separate the vas and the vessels from it The margins of the tear should then be seized with fine forceps and the attempt to free the whole circumference of the sac should be continued.

If further tears appear the opening may be allowed to gape and, guided by vision through the transparent peritoneum, the point of a blunt dissector or one blade of a dissecting forceps is gently worked across between the sac and the vessels behind it In infants even this manœuvre will often fail In such cases I lay the thin sac right open with scissors on its anterior aspect to within ½ in. of the neck and get my assistant to hold the margins open with forceps while he puts the cord on the stretch By this manœuvre the neck of the sac is seen from within as a small funnel The peritoneum just beyond this opening is carefully cut from within, using a small rounded knife (No 15 blade) the traction on the cord causing the cut to gape When the cut has been extended right round the neck, the proximal edges are teased free and picked up by three or four mosquito forceps The neck of the sac thus isolated and held up is further freed from the stretched cord by a few strokes of the closed scissors and tied off The rest of the sac should be laid open and the anterior part should be cut away leaving the posterior part still clothing the cord

(ii) *The treatment of the tunica vaginalis in congenital hernia* In congenital hernia the sac has no fundus that can be removed in continuity with the body The surgeon may either carry his separation of the sac down to the upper pole of the testis and then divide it closing the distal opening with a ligature or purse-string suture or he may carry his dissection into the scrotum, and remove the parietal layers of the

tunica vaginalis in continuity with the sac thus combining a radical cure of hydrocele with that of hernia The choice is a matter of personal preference The tunica vaginalis is a normal structure and must serve some purpose but there is no evidence that its removal brings any disability On the other hand hydrocele is slightly commoner after a hernia operation than it is in the general population I personally reconstruct the tunica vaginalis in a child and obliterate it in an adult

(iii) *The removal of lipomata* Any lipomata lying in the inguinal canal must be removed as part of the operation of cure of the hernia They stretch the muscles interfere with the action of the inguinal sphincter, and when springing from the extra-peritoneal fat they can undoubtedly cause a recurrence after removal of the sac by dragging down a fresh pouch of peritoneum Any obvious lipomata encountered in the sub-cremasteric space should be removed before the sac is disturbed. They can then be seen clearly and removed completely whereas later when they are stained with blood, their outlines are less distinct Pedunculated lipomata that come through the internal ring with the sac should be pulled down crushed at their neck and ligatured before they are divided

(h) Inguinal hernia in the female

The inguinal canal of the female is surprisingly like that of the male suggesting that the first mammalian prototypes experimenting with temperature control of the gonads extruded the ovaries as well as the testicles from the abdominal cavity The round ligament that takes the place of the cord, is smaller and less vascular and is not subjected to the same movements and alterations in diameter The channel is therefore smaller the cremaster less well developed and the conjoined muscle forms a less obvious arch but runs close above and almost parallel to Poupart s ligament Inguinal hernia in the female is nearly always oblique due to the persistence of a congenital sac that lies in front of the round ligament and accompanies it into the labium majus To separate this sac from the round ligament without damage to either structure is a difficult and tedious matter and in the opinion of most surgeons unnecessary The round ligament curtailed at the internal ring can apparently carry out its suspensory functions just as well as when it extends into the labium

The steps of the operation are the same as those of the standard

operation in the male down to the point when the cremaster is reflected from the round ligament. The sac and round ligament are now picked up and pulled gently while their distal extensions are cleared by blunt dissection from the tissues in the labium When the fundus of the sac has been exposed, any strands of tissue remaining distally including the termination of the round ligament may be crushed, tied, and cut across

The round ligament and sac are now held up and cleared as far as the internal ring The sac is usually so thin that it can be seen whether it is empty but if there is any doubt it must be opened and explored. This point settled, the sac-round-ligament bundle is crushed at the neck, transfixed, tied with catgut, and cut across ½ in. beyond the ligature Since the canal is now empty it can be obliterated with three stitches of No 1 catgut passed through the conjoined and cremaster muscles and Poupart's ligament and tied tightly enough to approximate the muscles but not to cut into them.

2 THE OPERATION FOR LARGER HERNIAE OF THE OBLIQUE TYPE

The standard operation described above offers the best chance of permanent cure in an early oblique hernia in a young person that is a hernia in which the posterior wall of the canal is sound, the internal ring is unstretched, and the muscular defences are intact Some cases are encountered however in which the internal ring has become damaged, but the muscular sphincteric mechanism of the canal remains apparently sound.

The neck of a congenital hernia lies above and to the outer side of the cord When it contains no bowel it is a potential space only that does not dilate the fibrous collar of the internal ring With the repeated entry of abdominal contents into the sac the neck becomes dilated and the ring becomes stretched to accommodate it At first only that part of the circumference occupied by the sac is stretched, that is the upper and outer segment and the inner border of the ring is not displaced. Later the whole ring becomes dilated, the inner border and with it the deep epigastric artery is displaced medially and the border instead of being a tough fibrous ring loses its definition The cord, though still bearing the same relation to the neck of the sac and the

artery leaves the posterior wall nearer the mid-line than is normally the case

An estimation of the size and displacement of the ring and of the strength of its borders *is necessary to the decision whether the inguinal* canal can still be retained as a functional sphincter A normal ring is the diameter of the cord when engorged with blood, roughly the diameter of a lead pencil Its margins are well defined, almost tendinous Such a ring needs no repair

If *the surgeon finds that the site* where he has tied and cut off the sac appears as a weak area lying lateral to the cord, but that the cord is not displaced medially the inner margin of the ring is firm and the deep epigastric artery runs a straight course he will be content with some simple approximation of this defect over the stump of the sac. *If on the other hand he finds that the ring as a whole is dilated, the* cord displaced, and the artery shifted, he can restore normal relations only by moving the cord outwards to that part of the ring formerly occupied by the neck of the sac and by repairing the weak area to its medial side

(a) Incision reflection of the external oblique aponeurosis and *the cremaster, isolation and ligature of the hernial sac*

These steps are the same as in the standard operation. The freeing of the neck of the peritoneal sac from the fibrous layer that surrounds it without damage to the latter is particularly important for if the stretched ring is further damaged any attempt to reconstruct a functional sphincteric mechanism is bound to fail

(b) Repair of the defect in the *internal ring*

The weak area is exposed by drawing the cremaster and internal oblique muscles strongly upwards with a small retractor thus bringing *into view the transversalis fascia* lateral to the cord the stump of the divided sac and the defect around it The integrity and strength of the margins of the stretched ring are demonstrated by *drawing the* cord upwards and laterally and holding up the infero-medial margin of the ring on a blunt hook. Unless these margins are strong repair of the ring is misplaced conservatism

I advocated reconstruction of the internal ring in 1936 Lytle published his method of *reducing the ring* while retaining its mobility in 1945 I have since amplified Lytle's operation by combining with it

the transplantation of an active fascial strip a further method that I had advocated in 1936 (Fig 23A)

The cord is displaced to the outer and upper part of the stretched ring and held there by a small retractor which at the same time keeps back the muscles and exposes the inner part of the defect The

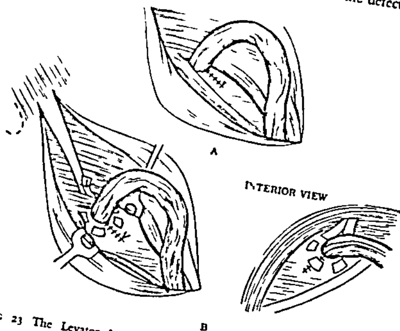


Fig 23 The Levator Annuli Interni operation operation for repair of a moderately stretched internal ring
(A) Suture of the stretched ring medial to the cord
(B) Support of the repaired ring by a musculo-fascial sling

margins of the defect are approximated by inserting a small blunt hook under its medial edge and drawing it firmly towards the pubis The defect is now closed by interrupted sutures of No 60 linen thread the first inserted at the hook, which is now taken out and the tied suture left long is used to continue the traction. The margins are approximated by further interrupted sutures working outwards till the ring is reduced to a diameter of 1 cm snugly enclosing the emerging cord.

A strip of external oblique ⅜ in. wide carrying its own nerve and blood supply is now mobilized from the upper leaf of the aponeurosis The aponeurosis is slit with a knife and the slit is continued with scissors in the line of the fibres right down to the pubis where it is cut across close to the bone The muscular part of the external oblique is now exposed by retracting the skin, and the separation of the strip is continued for 1 in into the muscular part the fibres being separated by gentle blunt dissection (Fig 23B)

The distal end of the strip is now threaded on a Gallie needle and passed obliquely through the muscular layers ½ in. lateral to the ring to emerge in the plane between transversalis and fascia just below the cord The needle and strip are then darned in and out through the repaired posterior wall ½ in. outside the margins of the ring as far as its upper margin, and then back through the muscular layers to emerge where they went in. The strip is then sutured to itself with a few interrupted stitches of No 60 linen thread, and any excess is cut off

The effect of this operation is to construct a fascial loop or sling surrounding and framing the internal ring and pulling up the ring under the muscular layers when the muscles contract just as the normal fibrous sling described by Lytle appears to do

(c) Closure of the wound

The cremaster is carefully sutured over the cord and the external oblique and superficial layers are closed in the same way as in the standard operation

I have performed this operation perhaps twenty times in the last ten years I know of no recurrence but any surgeon will know how little that means The operation springs from an admiration of the inguinal canal as one of Nature s greatest masterpieces and a wish to preserve that wonderful mechanism intact It has the fundamental weakness of all action based on emotional rather than factual reason, that it may be used in cases for which it is not suitable There are certainly cases in which a stretched internal ring can be repaired, leaving an inguinal canal as good as ever and as proof against recurrence A more practical view one to which I find myself leaning increasingly, is that inguinal canals like eggs are good or bad few are 'excellent in parts The good ones should be left undamaged the bad ones should be reconstructed rather than repaired.

3 RECONSTRUCTION OF THE INGUINAL CANAL

The first two operations are intended to preserve or restore the normal inguinal mechanism When this mechanism is beyond repair something much more elaborate is required the replacement of Nature s handwork by that of man The decision that such reconstruction is necessary is therefore one of considerable importance

The defences of the inguinal region are based on a system common to the whole locomotor apparatus of the body—a fibrous framework protected by a muscular guard, much as a frontier is defended by mechanical fortifications manned by living troops Under repeated attacks the forts may be damaged, but the garrison may remain effective ready to take over as soon as the forts are repaired or forts and garrison may be overwhelmed together But it is unlikely that the troops will be put out of action while the fortifications remain undamaged. Even so in the inguinal region the fibrous planes alone may suffer the muscles may atrophy with or after the fibrous planes but the muscles cannot give way alone leaving the fibrous tissues intact.

Reconstruction is necessary when the fibrous planes have yielded to an extent that renders repair impossible without encroaching on the muscles or when, with a lesser degree of fibrous tissue damage the muscles are also inefficient Any yielding of the posterior wall itself that is of the part medial to the deep epigastric artery is an absolute indication for reconstruction Enlargement of the ring lateral to the deep epigastric artery is remediable if the stretching is moderate and the margins of the defect are firm but beyond a certain point which may for practical purposes be taken as a diameter of an inch the enlarging ring encroaches so much on the posterior wall that the failure becomes a general one of the fibrous planes of the canal

An estimation of the conditions of the muscles is therefore of decisive importance only in those cases in which the fibrous defect is considered to be reparable provided the muscles can play their part that is cases considered suitable for the second operation Replacement of the cremaster muscle by fibrous tissue or fat thinning or bulging of the conjoined muscle or a pale flabby appearance of its fibres will determine the surgeon to reconstruct rather than restore A direct hernia always demands reconstruction

The reconstruction of a failed inguinal canal would be relatively

simple were the surgeon free to close the whole defect as he can in the female inguinal canal after excision of the round ligament with the sac In most cases he has the more difficult task of effecting sound repair while allowing free passage to the spermatic cord with its variable blood supply Castration is seldom permissible The device of reducing the diameter of the cord by excising most of the pampiniform venous plexus as in the original Halsted operation, is followed too often by pain hydrocele, or atrophy of the testes to be recommended

The majority of reconstruction operations fall into two groups—the operations of repair anterior to the cord and those of posterior repair The surgeon himself must decide which type is the more rational and he should be guided in his choice by basic principles rather than by the catch words" with which surgeons like priests and politicians seek to suggest the answer by the way they put the question Thus the advocates of anterior repair seek to justify their choice by saying that the cord is not dislocated from its bed The same surgeons never speak of 'dislocating' themselves or their patients from their beds in the morning nor do they 'dislocate' a shirt from the drawer when they dress They use a word suggesting violent rupture from natural bonds because they have already decided that they do not wish to reach the posterior wall of the canal

In my opinion the deciding factor is that an efficient and durable reconstruction depends on the production of firm fibrous tissues and that to be secure a fibrous channel transmitting a bundle of blood vessels must be long and oblique

An efficiently performed posterior repair will transmit the cord through two openings each rigid and of the required diameter placed far apart in strong posterior and anterior walls An anterior repair which takes no notice of the posterior wall may make a rampart equally strong but the channel that it leaves for the cord will eventually become a direct one lying close to the pubic spine (Fig 24)

The following description is of the form of posterior repair that I have myself found satisfactory It is a development of the operation that I first described in 1936 as Silk Lattice Repair , but I have modified it considerably since I returned to civil practice in 1945 I have abandoned strong silk (No 4 Chinese Twist) for fine thread (No 60 Barbour s linen thread) I no longer use a double lattice but I make a single one span the whole zone of failure and extend lateral to the internal ring and I do not attempt to incise the ring

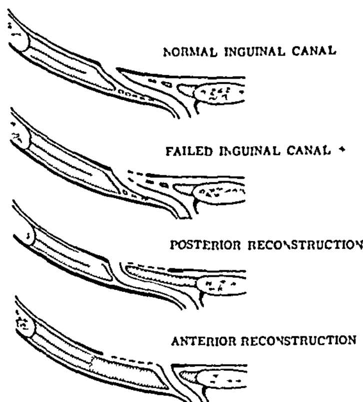


FIG 24 Alternative methods of reconstructing a failed inguinal canal

(a) Exposure of the defect

The skin incision and the reflection of the external oblique aponeurosis and of the cremaster are done in the same manner as in the standard operation and the modified standard operation The skin crease incision is particularly advisable in the operation of reconstruction because where thread is used, the early removal of the skin sutures and the divergence between the plane of the incision in the subcutaneous layers and that of the musculo-aponeurotic structures provide further safeguards against chance infection from without

If the hernia is an oblique one the cord is lifted from its bed the sac is separated in the usual way isolated to its neck ligatured and cut off If the hernia is direct the sac should on no account be opened

enough to lift the patient off the table if the catgut could stand the strain The stitch is trebly tied, and a second stitch is taken through Astley Cooper's ligament and the rectus sheath ½ in *more laterally* After this second stitch Astley Cooper s ligament should no longer be used as an anchorage since the ilio-pectineal line runs backwards and belongs *properly to the lateral wall of the pelvis and not to the abdominal wall* The suture is continued outwards in a lateral direction each stitch taking below a bite of the very tough layer that lies below Poupart s ligament and is compounded of the thickened edge of transversalis fascia and the lower origin of the cremaster and above the conjoined muscle The upper bite should include quite a fair amount of tissue as much as can be brought down to Poupart s ligament with only gentle tension

The suture is continued outwards about four stitches to the inch to the point of emergence of the cord At this point the cord is held strongly outwards, so that the last stitch can be tied behind the cord uniting the conjoined muscle to the para-Poupart fibrous layer and allowing only just room for the emerging cord While this suture is *being inserted the surgeon should make sure that the detached cremaster muscle is lying snugly behind the sutured layers for the whole length* of the canal I consider it important that the stitches in this continuous catgut suture should take their bite in the tough layer that lies deep to Poupart leaving a virgin and completely undamaged *Poupart for the* thread lattice that follows

(c) *The thread lattice*

The purpose of the thread layer as I now use it is not to add any considerable mechanical strength to the new posterior wall but to anchor all the layers in their new position while they become blended and to provide a permanent fibrous matrix for this important barrier

The upper margin of the zone of failure is first displayed by retracting the upper leaf of the external oblique aponeurosis to the line where it *becomes blended in the rectus sheath* An 18 in suture of No 60 linen thread of a No 5 needle is used The first stitch is taken through the rectus sheath just outside the point where the external oblique blends with it but a good inch inside the outer border of the muscle (Fig 27) It should be at least an inch lateral to the point of emergence of the cord and is tied there It is then passed downwards to pick up Poupart s ligament about an inch lateral to the emergence

of the cord back again to pick up the rectus sheath down again to Poupart s ligament till at the third or fourth stitch the point of emergence of the cord is reached Each loop on its downward journey is anchored by short passes through the muscles and each bite of Poupart s ligament picks up the ultimate upturned edge

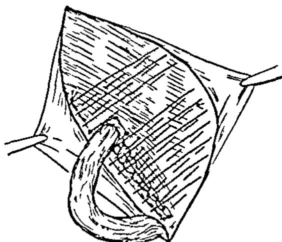


FIG 27 Second layer (thread) of reconstruction of the posterior wall

At the emergence of the cord which will become the new internal ring the thread is anchored by a single loop knot on Poupart s ligament then again just above and lateral to the cord, above and medial and finally again on Poupart s ligament just medial to the cord so that the new ring is surrounded and reinforced by a square of thread From the medial side of the ring the thread is carried back to the rectus sheath and down again to Poupart s ligament and so on at intervals of ½ in the loops spanning the whole zone of failure till the last is knotted at the pubis where the catgut suture started.

Finally the cord is laid back on the new posterior wall which is lightly dusted with penicillin powder The external oblique and skin are closed as in the former operations The after treatment is the same

CHAPTER 5

SPECIAL PROBLEMS IN INGUINAL HERNIA

Interstitial hernia

An interstitial hernia is an oblique inguinal hernia in which the direction of the sac and its relation to the spermatic cord differs from the normal arrangement of the funicular process Sometimes the whole sac may be ectopic More often a second sac is found that is a diverticulum from the main one there being a single opening at the internal ring communicating with the abdominal cavity Such a diverticulum may be congenital due to some abnormality in the mechanism of testicular descent in which case it is associated with late or imperfect descent of the testis or it may be acquired, due to distension by abdominal pressure of a sac that is obstructed distally by adhesions or by the pressure of a truss

Three varieties of interstitial hernia are described

1 *The Properitoneal* The sac extends within the abdominal cavity between the peritoneum and the transversalis fascia It may extend inwards towards the bladder upwards towards the umbilicus or outwards parallel to Poupart s ligament

2 *The Intra-muscular* The sac lies between the external oblique aponeurosis and the internal oblique muscular layer This hernia too may spread in any direction, but its inward extension is limited by the fusion of the external oblique with the rectus sheath.

3 *The Superficial* The sac after leaving the external ring turns back over the abdominal wall instead of extending into the scrotum

Of the three varieties the first can seldom be recognized on physical signs and it can be a source of diagnostic difficulty in the case of strangulation The second presents as a swelling with the main characteristics of inguinal hernia, but it can often be recognized because the outline of the swelling is obscured when the patient contracts the external

oblique The superficial type is sometimes mistaken for a femoral hernia

These interstitial herniae are of little more than academic interest and a trained surgeon will have no difficulty in recognizing the condition at operation and in dealing with it Only in the case of strangulation, when an obstructed loop may be concealed in such a diverticulum may they cause confusion.

Congenital direct hernia (See page 27)

This hernia is usually encountered as a surprise and its nature is not recognized until the external oblique layer has been reflected

The sac should be exposed with as little trauma as possible usually by incising any overlying muscular layer in the line of its fibres The peritoneal layer is exposed and mobilized without difficulty and then it is held up while the opening in the aponeurotic layer through which the sac has protruded is defined and cleaned By traction and a few snips with blunt scissors the peritoneal neck is defined After opening the sac to make sure it is empty the neck is tied cut beyond the ligature and allowed to drop back The margins of the aponeurotic hole are overlapped in the line of pull of the conjoined tendon with two or three sutures of No 60 linen thread.

Sliding hernia

These herniae are I believe always of the acquired oblique type (see page 26) The sac is wide-mouthed, rounded, thin-walled, and though it is lateral to the cord and has got into the same fascial layer it is quite distinct from vas and veins

A sliding hernia can present a very trying even a dangerous problem to the inexperienced surgeon The diagnosis of oblique inguinal hernia has been made with confidence and the operator after reflecting the external oblique and opening the sub-cremasteric space is pleased to find that the diagnosis is correct He then picks up the sac in front and proceeds to work round it carefully stripping off all adherent structures Half way round the circumference he comes on veins that will not strip These are the posterior caecal veins and if he does not then recognize that he is dealing with a sliding hernia he will proceed with increasing vigour and determination until he is faced with copious haemorrhage or a ragged hole in the back of the caecum or pelvic colon

As soon as he knows that he is dealing with a sliding hernia he must realize that the sac is a matter of no importance It must be cleaned but this can be done in a few moments with a dry swab or blunt scissors It need not often be opened and it should never be excised. If the *empty part of the sac where its wall is not formed by a* sliding viscus is roomy that part should be excised and the edge should by sewn up again to make a smaller sac but usually it is wisest to push the unopened sac and its contents back into the abdomen, clear the cord from its cremasteric coverings and reconstruct the inguinal canal The security of such a repair depends entirely on the soundness of the reconstruction, and not at all on the removal of the sac.

Very large herniae

An inguinal hernia which has stretched both inguinal rings and become uncontrollable by a truss will grow rapidly and often attain an enormous size within a year or two The skin is stretched and often ulcerated over it and the penis entirely buried the urine passing through a small slit and adding to the soreness of the skin the contents *are adherent and irreducible and often too bulky to be accommodated* in the abdomen could they be reduced The patient suffers from the immobility enforced upon him and from absorption of toxins in his obstructed coils he is fat emphysematous and has poor heart muscle

Such cases present a very difficult problem The patients are unable to work almost unable to get about On the other hand strangulation is much less likely than in smaller and more reducible old herniae, and their operative risk taking into consideration the magnitude and difficulty of the task and the condition of the subject is almost prohibitive *The only apparatus that can be provided is a bag truss* but with this the increase in size is arrested and a certain amount of activity is possible

Operation should be undertaken only if there is some special reason to commend it and after the risks have been pointed out By using local anaesthesia by stopping the operation at any time on the appearance of collapse and completing it if necessary in two or three stages it is usually possible to alleviate all but the worst cases The amount of tissue to be replaced in the abdomen is very materially reduced by *excising* all omentum that lies in the sac These operations are definitely not cures but they will allow the patient to get about afterwards with a well fitted truss *and to improve his health by exercise*

Recurrent herniae

A hernia appearing in an inguinal canal that has already had a hernial repair is not necessarily a recurrence A direct hernia is so common in older men that it must be expected that many of these will occur in inguinal canals in which an oblique hernia has already been successfully repaired If the second hernia appears five years or more after the first it should be regarded as a fresh one

Apart from the inevitable fallibility of the inguinal region with advancing years which means that a certain number of hernial repairs will fail eventually however well they have been performed, the causes of recurrence may be attributed to the surgeon, or to the method

It is unfortunate that in many Medical Schools the repair of herniae is regarded as a matter of minor importance Senior surgeons seldom perform the operation themselves nor do they often demonstrate the steps to their juniors or supervise them when they do it for the first time In the Review by the Statistical Department of the Army Medical Service to which I have referred previously (page 34) it was reported that in a series of nineteen operations for recurrent hernia in fifteen failure to excise the original sac was the cause for recurrence

The second cause of recurrence which is often combined with faulty performance is the use of the wrong method To say that any method is wrong is after all no more than a personal opinion I will therefore enumerate the causes of recurrence roughly in the order of their frequency in the cases that have come to me for a secondary repair

The most frequent finding has been the recurrence of an oblique hernia within a few weeks or months of an operation for the cure of oblique hernia Usually the sac has not been identified or removed and it lies in its normal position undisturbed Often the sac has been dissected out but not removed up to its neck and the remnant left behind has dilated again Sometimes the sac has been tied off at its neck, but the stretched internal ring has not been repaired and a fresh oblique hernia often of the sliding type has come down through the weak area

The second commonest cause of recurrence in my experience has been the performance of the classical Bassini operation The sutures pull the muscles out of their normal line of action and if tied tightly strangulate them In any case sutures alone however placed and

however tied, cannot perpetuate the displacement and the muscles tend to leave Poupart's ligament and return much damaged, to their original position The result is a direct hernia

Next to Bassini in my experience has been the reconstruction of the inguinal canal by a nylon lattice Nylon appeals to many surgeons because it is strong produces no reaction and is not extruded even in the presence of sepsis But it takes no part in repair, and tissues sutured under tension with nylon return to their original site leaving the nylon where it was put A nylon darned hernia fails, not because the nylon has done any harm but because it has done no good

Finally hernia repairs fail because the method of repair has damaged the delicate tissues of the inguinal canal and particularly Poupart s ligament the key to the inguinal region Fascial strips and floss silk sutures are both wreckers of Poupart s ligament Fascial sutures remain alive and are incorporated by living fibroblasts in the tissues into which they are woven But they tear Poupart s ligament into longitudinal strips and they are too short to bridge the zone of failure effectively They are woven into the internal oblique layer which is capable of further yielding and they cannot be spaced close enough to form a secure barrier Direct herniae may force their way through the rigid openings which are left between the strands

Floss silk is as destructive to Poupart s ligament as fascia but it is more irritating and in the presence of sepsis it must be removed piecemeal an interminable task

THE OPERATION FOR RECURRENT HERNIA

The repair of a recurrent hernia necessarily requires a reconstruction of the inguinal canal The incision is dictated by that previously used, which is in most cases the conventional one parallel to Poupart s ligament

The incision

The skin is first marked with three or four lines drawn in skin ink at right angles to the previous scar The scar is outlined by two cuts which meet at the ends and are continued at the outer end for ½ in. for it is here that the deeper planes can be identified in undisturbed tissues The cuts are deepened to the external oblique layer and the

dissection is continued between fat and aponeurosis towards the scar of the incision The scar with the elipse of fat is removed and the deeper layer of fat is trimmed with scissors till the scar in the external oblique is laid bare Care is needed at the inner end to avoid damage to the emerging cord and it is wise at this point to identify the cord well beyond the scar of the previous operation and to hold it up with the fingers while it is freed.

Reconstituting the canal

The external oblique aponeurosis is incised just lateral to the previous scar and the cut is continued in the same line through the scar tissue The two edges of this cut are held in toothed forceps and the surgeon frees the upper flap with a knife working on the deep surface of the external oblique aponeurosis in the line of its fibres and parallel to its plane The right plane is easily established to the outer end of the incision where the internal oblique layers have not been disturbed by the previous operation but more medially it may be difficult particularly if fascial strips or unabsorbable materials have been used. Towards the external ring the dissection requires care as the structures of the cord are often adherent to the aponeurotic layer that overlies them, and the veins and still more the vas may be easily cut

The lower leaf is dissected in the same way until the lower edge of Poupart s ligament is displayed down to its insertion in the pubic spine Once again the correct plane is easily established towards the outer end of the incision where the layers have not been disturbed previously but from the internal ring to the pubic spine they may be almost unrecognizable if fascial strips from the thigh or the external oblique or silk or nylon sutures have been used to darn Poupart s ligament Nevertheless the whole length of Poupart s ligament must be displayed or a satisfactory reconstruction will be impossible This step implies slow and patient dissection with a sharp knife working parallel to the surviving fibres of the ligament where they can be recognized and dividing the darning material whatever its nature Sutures of foreign material should be removed as they are cut but fascial sutures can be left to play their part in the new fibrous posterior wall that will be reconstructed

Having reflected the external oblique medially as far as the point where it blends with the rectus sheath and laterally to Poupart s

ligament the *surgeon must now* free the cord as far as the internal ring The cremasteric layer has probably been removed, destroyed, or incorporated in the previous repair but the cord *must be dissected free* from any structures whatever their nature that overlie or underlie it by sharp dissection while it is held up and drawn medially with finger and thumb till the point where it comes out of the transversalis layer and under cover of the internal oblique layer is reached

Reconstruction of the posterior wall

This is effected by a thread lattice repair as described in Chapter 4 page 51 but the material available is very variable If the previous operation was an inadequate herniotomy for oblique hernia the operation is straightforward If some reconstruction has been done the cremaster has almost certainly gone and the internal oblique has probably been damaged On the other hand the total material available is probably adequate and viable and it may even be better than usual owing to the incorporation of fascial strips It is brought down as described previously to the tough para-Poupart layer of fibrous tissue that lies *immediately deep to the aponeurotic fibres of the ligament* by a continuous suture of No o catgut that extends from the pubic spine to the internal ring

This continuous fibro-muscular sheet lying behind the cord is kept in place and reinforced by a lattice of No 60 linen thread woven from the rectus sheath to Poupart s ligament extending one inch lateral to the emerging cord and enclosing this point of emergence by *a square of thread stitches knotted at each corner*

The previous repair has sometimes so damaged the distal parts of the cremaster and conjoined tendon, that not enough material is available to make a strong posterior wall to the all-important inner end of the canal This difficulty is overcome by a vertical relaxing incision in the inner end of the rectus sheath deep to the external oblique (Fig 28) This incision need not be more than an inch long but *it allows the outer edge of the rectus sheath* and with it any internal oblique fibres remaining to be approximated without tension to the inner ½ in. of Astley Cooper s ligament

After reconstruction of the posterior wall the canal is dusted with penicillin powder and the external oblique is closed with a continuous suture of No 1 catgut The skin and subcutaneous layers are closed carefully by a series of fine nylon sutures tied over a gauze roll

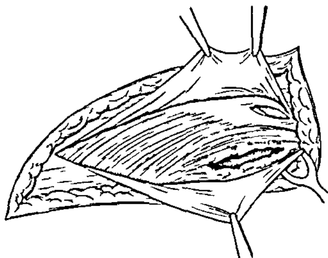


FIG 28 Operation for recurrent hernia The relaxing incision in the rectus sheath (The cord has been omitted from the figure)

after the skin edges have been accurately approximated with Michel clips Meticulous skin closure is essential after the repair of a recurrent hernia because early first-intention healing is the surest safeguard against infection of the deeper layers of the wound

Castration

The inguinal canal is the rent in the abdominal parietes caused by the emergence of the testis and with the removal of the testis it becomes no more than a gap in the muscular layer that can be repaired with the same ease and the same certainty as any other ventral hernia In any difficult repair particularly in a hernia that has recurred several times the advisability of removing the testis should be considered, and the *consent of the patient to such a step if considered* advisable should be obtained. To castrate a patient without permission is dangerous Most men s ego is to some extent linked with their virility or its memory and they would look on the removal of any part of their external genitalia as an intolerable affront

Actual removal of the testis is not absolutely necessary Where a patient has refused such a course I have on several occasions obtained the same security by dividing and ligaturing the cord at the internal

ring and, after repairing the hernia, attaching the stump to the external oblique aponeurosis near the closed external ring The testis is, of course dead, but if the wound *is clean it remains* uninfected and atrophies only slowly remaining in the scrotum as a symbol. Only once have I known it to slough

The empty inguinal canal is closed by stitches of stout catgut, bringing the muscular layers down to Poupart s ligament without tension. A further lattice of No 60 thread may be added if considered advisable

Reconstruction of Poupart s ligament

Poupart s ligament is the representative in man of the fibrous barrier found in all quadrupeds where the anterior abdominal wall meets and blends with the flexor muscles of the thigh. It is infinitely older than the inguinal canal, and it depends for its security on being tied by and to every fascial plane in the neighbourhood—the fascia of the muscles the fascial envelope of the thigh, the fascial sheaths of the vessels and *the fascial septa that dip between the muscles and get attachment to the* bones of the pelvis and the capsule of the hip joint The ligament is not merely invaluable it is irreplaceable. The advice given by some surgeons that it may be divided to help the reduction of a strangulated femoral hernia, or that the lower attachments of the ligament to the fascia lata of the thigh may be cut to help the repair of an inguinal hernia is unsound and dangerous

When Poupart s ligament has been cut across detached from its deep connexions or lacerated by fascial or floss silk sutures secure *repair of an inguinal canal that still transmits the cord is impossible* The testicle should be removed, or the cord should be removed from the inguinal canal by division at the internal ring The anterior abdominal wall can then be re-attached to the flexor muscles of the thigh by a series of stitches picking up the remains of Poupart s ligament Astley Cooper s ligament medial to the femoral vein, the psoas fascia lateral to the external iliac artery in fact any structure fibrous enough to give a secure hold.

Something more is needed when the recurrent hernia is a femoral one *In such a case a strip of fascia lata may* be passed through a drill hole in the body of the pubis and attached laterally to the remains of Poupart s ligament (*which always survives in its outer half*) A fascial dam between this strip and Astley Cooper s ligament medial to the femoral vein completes the barrier retaining the peritoneum.

THE OPERATION FOR UNDESCENDED TESTIS

A fully scrotal testis is unusual in a new-born infant During infancy testes are normally highly retractile and under the stimulus of cold or skin contacts they are drawn up into a subcutaneous pouch overlying the pubis It is therefore important to distinguish between a retractile testicle and a blocked testicle The retractile testicle will descend into the scrotum at or shortly before puberty the blocked testicle will never descend. Hormone therapy has no place in the treatment of undescended testes If the testes are merely retractile the administration of hormones may hasten their inevitable descent by a few months or even years but at the expense of precocious enlargement of the external genitalia and irreparable psychological damage If the testes are blocked hormone treatment is equally harmful but quite useless

The distinction between non-descent and blockage is easily made If the testis is merely retractile it can be persuaded to come down momentarily into the scrotum by repeated gentle stroking in the line of the inguinal canal with the finger while the child lies relaxed and warm if it is blocked no amount of stroking will bring it below the pubis A retractile testis (and indeed a blocked testis) is doing no harm and suffering no harm till the onset of spermatogenesis Any treatment therefore should be postponed till the age of ten or later if normal descent seems to have started then.

The incision

As in all operations on the inguinal region, the crease incision is to be preferred. The cut after ligature of the superficial vessels is deepened to the plane between Colles fascia and the external oblique aponeurosis and dissection is extended in this areolar plane with small ball swabs until the whole external ring is displayed down to the pubis The testis will then be seen either drawn up to the external ring or lying within it covered by the intercolumnar fascia

The external oblique is split in the line of the pillars of the ring and the inner and outer leaf are turned back as far as the rectus sheath and Poupart s ligament exposing the muscular layers The cremaster is picked up between toothed forceps and incised in the line of its fibres and the sub-cremasteric space is opened up The cord and testis are almost certainly lying in a congenital hernial sac of very thin peritoneum and they should be mobilized as a whole by carrying the

reflexion of the cremasteric flaps back till the cord is free Still keeping the sac unopened the testis is drawn up by traction with finger and *thumb and freed by dissection* with non-toothed forceps from its attachments in the scrotum This dissection is difficult The undescended *testis is usually imperfectly* finished and the epididymis is a long structure loosely attached to the corpus testis In drawing the testis out of the scrotum the epididymis lags behind and must be progressively freed Finally a point is reached when the tissue being drawn up is clearly fibrous and not secretory that is it represents gubernaculum and not epididymis This fibrous band is divided between haemostats The distal stump is ligatured and allowed to drop into the scrotum and the path into the scrotum is defined by passing curved Mayo scissors down into it and opening them gently and repeatedly

The hernial sac is now opened The difficulties mentioned on page 45 will be encountered but it is only necessary to remove the anterior wall of the sac in its distal part, and, while drawing the testicle downwards to mobilize the peritoneum where it forms the internal ring dissect it free from the constituents of the cord, ligature it and drop it back

It is now necessary to make sure the testis can reach the scrotum The vessels of the cord and the vas are seldom short and the barrier *to reposition is a number of fine fibrous bands that can be divided* after they have been identified and put on the stretch Provided that the testis can be placed and maintained in the scrotum without trauma the cord will stretch afterwards to the required length The absence of trauma is the one essential for it is futile to replace in the scrotum a testis that has been destroyed by the method of replacement The operation commonly advocated that of Thorek whereby the testis is held down by stitches to the fascia of the thigh is an example of inexcusable trauma and it is unlikely that any testis subjected to such treatment will survive to function The method of trans-scrotal reposition of Philip Turner that retains the testis by an elastic pull that slowly elongates the cord, is preferable

To retain the testis the closed haemostat holding the gubernaculum is pushed down into the scrotum and across the mid line to present on the opposite side (Fig 91) The presenting point is cut on to with a knife and thrust through the skin. The jaws are opened, the crushed gubernaculum is seized by a second pair of haemostats and the first pair is withdrawn. While the gubernaculum is drawn down, the

small incision in the scrotum is enlarged with a knife to a diameter of an inch and closed scissors are inserted on each side between the skin and the median septum and opened to make a pocket for the transposed testis Further traction on the gubernaculum now brings into view *the hole in the septum through which it emerges* While the gubernaculum is pulled down with care the septum is pushed back over

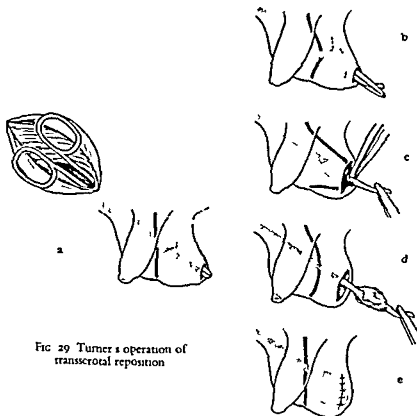


FIG 29 Turner s operation of transscrotal reposition

the testicular complex by a non-toothed forceps held in the other till quite *suddenly* the whole pops through and is *held* from returning by the elastic grip of the septal tissues

The testis is tucked into the scrotal pocket and the edges of the small incision in the scrotum are brought together by interrupted stitches of the finest nylon The wound is dressed with Mastisol or Whitehead s varnish and the stitches are removed in a week

Returning to the inguinal wound, the incision in the cremaster muscle and that in the external oblique are closed by continuous sutures of catgut and the superficial layers are closed, as in other inguinal operations by a pressure dressing and Michel clips

OPERATIONS FOR INGUINAL HERNIA IN INFANTS

Operations on the inguinal canals of small babies should be avoided if possible The subcutaneous tissue in the region is fat and deep and landmarks are hard to identify The aponeurotic layers reach their full development only as the result of continuous muscular action, and at birth the external oblique aponeurosis and Poupart s ligament are barely identifiable sheets of thin transparent fascia The cremaster is a thick muscle, but the underlying hernial sac can barely be handled without tearing At the same time the child except in rare cases is in far greater need of the nutritional and psychological care of the mother than of the professional care of the surgeon, whose efforts he is prone to treat without regard to the needs of asepsis

Inguinal herniae in infancy are rarely uncontrollable and even more rarely dangerous and operation can usually be postponed till weaning is accomplished and the early infectious crises are over—say till the age of 2 or preferably 4

CHAPTER 6

Inguinal Hernia—Standard Operations that are not Recommended, and Why

1 BASSINI S OPERATION

As in all classical operations the conventional incision is used one placed an inch above and parallel to Poupart s ligament and extending from just above the external ring to just above and lateral to the internal ring The external oblique is incised throughout the length of the canal The cord is freed from the cremasteric fibres and the hernial sac is separated from the other constituents of the cord as far as the internal ring ligatured and divided

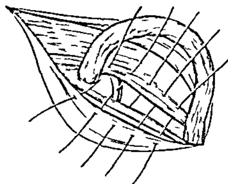


Fig 30 Bassini s operation

The isolated cord is now held up and the internal oblique and conjoined tendon the cremaster and the transversalis fascia are united behind it to the inner shelving margin of Poupart s ligament to make a new floor to the inguinal canal (Fig 30) Bassini himself made a point of detaching the transversalis fascia from Poupart s ligament and separating it from the underlying extraperitoneal fat but this step is not followed by most surgeons Bassini again first made the new floor

by a continuous suture starting at the internal ring but later he used interrupted sutures starting at the inner end of the canal and finishing at the internal ring He also used silk, but later surgeons have for the most part used stout catgut

Each stitch takes a good bite 2 to 3 cm from the edge of conjoined tendon cremaster and transversalis fascia, and then picks up the inner shelving edge of Poupart's ligament The first stitch is placed close to the pubic spine and the last one about 1 cm lateral to the position of the internal ring Four to six stitches are usually required, and all are inserted before any one is tied

The stitches are tied behind the cord which is then laid back on its new bed The external oblique aponeurosis and the skin are closed in turn

Bassini was a pioneer He was the first surgeon[1] to make a rational attempt to repair inguinal hernia by insisting on isolation and ligature of the sac at its neck and the construction of a new posterior wall to the inguinal canal behind the cord His operation introduced a new epoch and all successful operations since his day are founded upon his work Nevertheless the classical Bassini operation *should* not be done today Its place like that of all pioneer efforts is in the historical museum.

The inguinal canal is a physiological mechanism, a sphincter If the muscles are still good they should be preserved if they have failed they cannot be relied upon to make a strong wall *The failures of the* Bassini operation vary from none to 50 per cent according to the length of the follow up and whether it has been conducted by the surgeon who did the operation or by an independent observer

2 THE WILLYS ANDREWS OPERATION

Bassini s operation was first performed in Padua in 1884 and first described by him in 1888 and published in 1890 Willys Andrews *imbrication operation* which was the first attempt to overcome the fundamental weakness of the Bassini method was published in 1895

The skin incision and the exposure of the external oblique are made in the usual manner but the pillars of the ring are carefully defined

[1]He was preceded by Marcy of Boston who however did not convince his contemporaries.

and the subcutaneous fascia is cleared from the aponeurotic layer for an inch below Poupart s ligament The incision in the external oblique is also made in the usual manner but it is placed at least 3 or 4 cm above Poupart s ligament so that the lower flap is sufficiently wide to cover the cord at the end of the operation

The aponeurotic flaps are reflected the cremaster is incised the cord is lifted from its bed and the hernial sac is dissected out and ligatured at its neck as in Bassini s operation. The essential part of the operation is that a strong fibro-muscular posterior wall is made to the canal from conjoined tendon, cremaster and upper leaf of the external oblique aponeurosis (Fig 31A) This flap is brought down to Poupart s ligament by a number of W stitches Each stitch is passed first from the fascia of the thigh below Poupart s ligament into the inguinal canal while the femoral vein is guarded by a finger then through the cremaster and conjoined tendon from within outwards then back through the recurved edge of Poupart s ligament then through the upper leaf of the external oblique aponeurosis and lastly back through the lower half of the external oblique close to Poupart s ligament (Fig 31B) The effect of this stitch when tied on the other surface of the aponeurosis is to bring the upper aponeurotic flap and the conjoined muscular sheet down above and below the shelf of Poupart s ligament which projects between them The first stitch is at the medial end of the canal and should pick up Gimbernat s ligament the last should be just medial to the point of emergence of the cord. Each stitch, when it has been inserted should be caught with artery forceps and none should be tied till the series are in place Willys Andrews himself used a small number of stout W sutures of Kangaroo tendon, but a larger number of stitches of good catgut more closely spaced is better

When all the stitches have been tied the cord is laid back on the new posterior wall just above Poupart s ligament and the lower leaf of the external oblique is sutured over it to make a roof for the canal The suture is started at the lateral end and continued inwards till the external ring is reduced to the size of the tip of the little finger

The Willys Andrews operation has maintained its place as a sound method of reconstruction in those cases in which the aponeurotic layers are sufficiently good to permit imbrication Unfortunately in many cases in which it is most needed the external oblique layer is so thinned by the hernia and the pressure of a truss that it is of little value as repair material I have abandoned it because it has not been

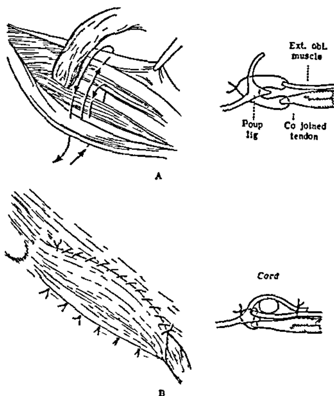


FIG 31 The Willys Andrews operation

(*a*) Details of the W stitch which draws the conjoined tendon and the upper leaf of the external oblique aponeurosis down to Poupart s ligament

(*b*) Suture of the lower leaf of the external oblique aponeurosis in front of the cord

available in the cases in which I needed it most because the aponeurotic overlap at each end of the canal tends to constrict the vessels of the cord, and because it had no advantage over the thread lattice (page 51) which is applicable in every case

3 SCHMIEDEN'S OPERATION

Schmieden s operation was based on the observation that closure of an empty inguinal canal after removal of the testicle nearly always leads to cure of a hernia

After isolation and ligature of the sac in the usual manner, Schmieden pulled the testis into the inguinal canal and dissected it free of its scrotal connexions *He then burrowed between the transversalis fascia* and the conjoined tendon and made a split in the internal oblique and transversalis muscles in the line of their fibres about an inch above the internal ring (Fig 32) He drew the testis through this opening which he then closed round the cord with one or two catgut stitches He completely obliterated the now empty inguinal canal by suturing the conjoined tendon to *Poupart s ligament throughout its length* He replaced the testicle in the scrotum and repaired the external oblique over the cord

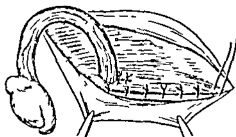


FIG 32 Schmieden s operation

Schmieden s operation is attractive in that the cord, instead of passing through a ring already stretched by the hernia is led through a fresh opening in healthy muscle and the new inguinal canal is longer and more oblique than the one it replaces I have not tried it because the Brandon operation which was published in 1946 seemed to offer the same or greater advantages

4 BRANDON S OPERATION OF LATERALIZATION OF THE CORD

Brandon,[1] reviewing contemporary practice of hernia surgery agrees that for congenital hernia with good muscles removal of the sac alone is the surest safeguard against recurrence He considers that in larger oblique herniae treated by operations of the Bassini type

[1]W J M. Brandon, *Lancet* 1945 I 167

recurrence is due to one factor alone that the true internal ring is overlapped completely by the lower border of the internal oblique muscle In consequence closure of the so-called internal ring at the operation does not occur at the true internal ring but at a point ½ to ¾ in. lower down the cord' He proposed to scrap the stretched and weakened internal ring entirely, and construct a new one

The operation

The steps of the standard operation are followed up to the point where the cremaster has been incised and the cord has been isolated The internal oblique and transversalis muscles are now divided close to their origins from Poupart s ligament in the line of the inguinal canal for a distance of 1 to 1½ in (Fig 33) The sac is then isolated

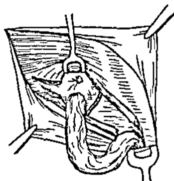


FIG 33 Brandon s operation

ligatured at its neck and excised Two small retractors are inserted and the cut ends of the muscles gently separated This gives an unimpeded view of the stretched internal ring and allows a comparatively easy closure of the stretched or torn transversalis fascia Once this has been accomplished the cord is brought well up into the V of the incision, and held with slight tension while the two arms of the V are sutured with two or three interrupted catgut of silk sutures thus reconstituting the cut muscles round the cord which now emerges through a well-fitting aperture placed well out in a lateral position.

The conjoined tendon is then sutured to Poupart s ligament by a series of interrupted catgut or silk sutures thus closing the old internal ring and the entire inguinal canal The external oblique is repaired over the cord and the skin incision closed in the usual manner

The operation in this form is a modified Bassini with the following advantages

i The cord now emerges through a newly constructed and well-fitting muscular internal ring well away from the danger area'
ii The new canal is longer and more oblique than the one it replaces
iii The repaired outlet for the cord through the transversalis fascia now abuts directly against the newly constructed muscular ring allowing no leeway for the formation of a new sac

The article in which Brandon propounded this operation, his assessment of the causes of failure of the older procedures and the reasons that led him to design this new operation of lateralization, are a fine example of surgical thinking Impressed by his reasoning and knowing his excellent record as a war surgeon I adopted his operation with enthusiasm and combined it with a silk lattice re-enforcement in the treatment of the failed inguinal canals that I encountered in a hospital that has the reputation of attracting the failures of surgery elsewhere

After a series of successful results I had two or three recurrences of a type new to me a direct hernia at the internal ring of the type that is common after the purely posterior repair operations It is possible that I had not repaired the stretched opening in the transversalis fascia with the care on which Brandon insists but I attributed the failure to the fact that the new ring is made through purely muscular tissue with no fibrous component The origin of the internal oblique and transversalis muscles from Poupart s ligament where they arch over the emerging cord is almost tendinous and the new opening constructed in the Bassini type of posterior repair though it does not correspond exactly to the deeper opening in the transversalis fascia is nevertheless rigid and fibrous The Brandon lateralization cut divides these tendinous fibres and then cuts soft fleshy muscles across their fibres Such muscles however carefully sutured after division, are not material to form good fibrous tissue

5 GALLIE S OPERATION OF FASCIAL REPAIR

The preparatory steps of the operation the mobilization of the cord and the isolation and ligature of the hernial sac at its neck, differ in no

essential details from other methods of hernial repair The essential technique of fascial suture may be quoted from Gallie s article.[1]

' The first suture of fascia lata a quarter of an inch wide is anchored securely into the rectus sheath close to its attachment to the pubic bone The needle is now passed behind the spermatic cord to pierce Poupart s ligament at its insertion into the pubic spine (Fig 34a) If possible it should be made to pick up the periosteum to make the security of its fixation more certain. When the suture is drawn taut the weakest spot in the abdominal wall namely that which lies behind the external abdominal ring is filled with a tough aponeurotic tissue which effectively prevents any bulging through the ring The sewing is continued in an outward direction drawing the internal oblique muscle to the reflected portion of Poupart s ligament behind the cord, until the position of the internal ring is reached Here the suture is locked and then carried to the outer side of the ring where a supporting stitch is inserted. In this way the cord, at the point where it disappears through the abdominal wall is surrounded by a fibrous ring which will effectively prevent the development of a hernia at this point By locking each stitch at this stage the possibility of undue constriction of the cord is prevented The sewing of the internal oblique muscle to Poupart s ligament in this manner is a detail of the operation which in our opinion is of very little value in preventing recurrence of the hernia It is of value however in permanently covering the peritoneum with a thick layer of muscle which will prevent the protrusion of peritoneum through the chinks of the next layer of sutures which is the important one in the prevention of recurrence (Fig 34b) This layer commences as a continuation of the first at the outer side of the internal ring The needle takes a solid bite of the abdominal aponeurosis at its point of fusion with the external oblique and is then passed behind the cord to pick up Poupart s ligament The suture is carried backwards and forwards across the space with frequent lock-stitches until the sheath of the rectus is reached, and thus also is woven to Poupart s ligament until the whole space is filled with fascia down to the pubic spine No attempt is made with the second row of sutures to drag the abdominal aponeurosis and the rectus sheath out of their normal positions No greater tension is exerted on the sutures than is sufficient to make them lie flat The whole idea of the operation is to fill the weak spot in the abdominal wall with what

[1] W E. Gallie and A. B le Mesurier *Brit Journ Surg* 1924 12, 46 315 19

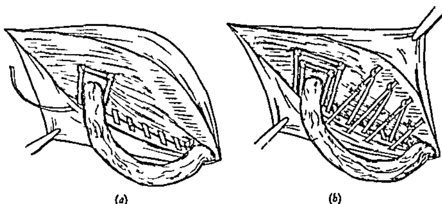


FIG 34 Posterior repair of inguinal canal by fascial suture

may be called a filigree of living aponeurosis and to depend on the strength of this filigree and on its grip on the surrounding tissues for the cure of the hernia What one does with the external oblique is of relatively little importance Usually in direct hernia it is too weak to be of any value to the surgeon. In our earlier operations we closed it down to the external ring with a narrow strip of fascia but in the last four years we have simply sewn it up with catgut

This operation, which I supported strongly in 1936 I have now abandoned because though it is based on excellent research work it damages Poupart s ligament the key structure of the inguinal canal irreparably If it fails it leaves a bad headache for the surgeon who comes after

6 MACARTHUR S OPERATION

MacArthur advocated a method of darning by fascial strips similar to that of Gallie but he used strips cut from the upper and lower flaps of the external oblique aponeurosis The strips are left attached at the pubic end where they form part of the pillars of the external ring and are attached to the pubic bone They are divided at the lateral end where the aponeurosis joins the muscular fibres Each strip is threaded on a fascial needle and is used, as in the Gallie operation to darn the conjoined tendon to Poupart s ligament

The advantage of the MacArthur procedure is that the operation is shortened no second incision is required in the thigh and the first anchoring stitch is unnecessary as *the strips are already attached to the* bone On the other hand, the fascial material is almost necessarily limited to two strips and in a large hernia these may be of poor quality With this amount it is difficult to reinforce the internal ring with a double ring of fascia as Gallie recommends The diameter of the strips renders this operation open to the same objections as Gallie s that they wreck Poupart s ligament

7 THE McGAVIN SILVER FILIGREE OPERATION

This operation differs from all others in that the strength of the repaired inguinal canal depends on the presence of a rigid unstretchable plaque and not on *stitching or the mobilization of tissues* The description is quoted from the author[1]

The principles which underlie the operation are the removal of the sac the approximation of the conjoined tendon to Poupart s ligament and the rendering absolutely unstretchable of the whole operative cicatrix by the introduction of a scaffolding of silver wire known as filigree When an aseptic filigree of silver wire is introduced into the tissues of the inguinal canal there follows exudation of *lymph which rapidly organizes about the filigree and in a very short* time new vessels and young fibrous tissue are produced, and entangle themselves among the wire of the filigree to such an extent that a solid plaque is formed that converts the inguinal canal into a sound, resistant area which will neither stretch nor bulge the muscles peritoneum and aponeurosis being welded together by the filigree

The method of constructing filigrees given in the above chapter is not repeated but it can be followed from the illustrations The filigree being made by the surgeon *is tailored to the particular hernia* (Fig 35)

Method of implantation The filigrees should be placed in ether for five minutes to remove all grease from them, and should be left in the sterilizer in the centre of the most actively boiling area until the moment of implantation

[1] Lawrie McGavin, Choyce s *System of Surgery* 2nd Edition Vol 2 page 596 Cassell & Co Ltd 1923

The operation is at first conducted exactly as in performing an ordinary Bassini s closure after the sac has been removed, by a little blunt dissection a bed is made between peritoneum and conjoint tendon and the pubic section of the filigree is laid flat in it the conjoint tendon is then sewn to Poupart s ligament with a row of sutures placed in front of the filigree The iliac section of the filigree is now taken from the sterilizer and placed beneath the aponeurosis in such a way

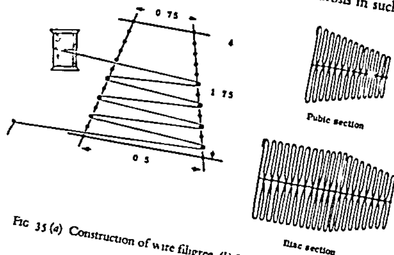


Fig 35 (a) Construction of wire filigree (b) Filigree ready for insertion
(a) Pubic section
(b) Iliac section

that its inner end lies over the internal abdominal ring and upon the cord for a space of ¾ in the outer end being carried outwards and laid upon the surface of the internal oblique muscle one or two sutures holding it in place (Fig 36) If the muscular wall lateral to the internal ring is weak it is divided from the ring outwards towards the iliac spine for about an inch and is separated from the peritoneum by the handle of a scalpel upon this peritoneum the outer end of the iliac section is laid being lightly sutured in place and the muscles are brought together again over it the inner end lying as already described. Finally the aponeurosis is sutured in place and the wound closed.

It will be seen that the cord comes to be sandwiched between two layers of filigree in the canal the natural relations of which are

hardly altered, and further that the area outside the internal abdominal ring is fortified by a filigree which may be made of any size that may be deemed necessary

Granted a primary union of the wound the hernial gap will be found to become as *impermeable* and *unstretchable* as a pad of leather There will be neither pain nor discomfort afterwards there is no interference with the cord or with the functions of the testis and the necessity for any form of truss is done away with permanently

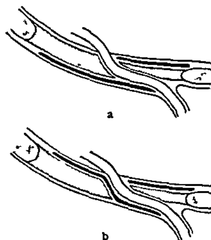


Fig 36 Filigree in position

(*a*) As normally placed
(*b*) Alternative position in large herniae

McGavin s operation has an excellent reputation Like John Brown its author is in the grave but his soul goes marching on His successors at the Seamen s Hospital Greenwich to which merchant seamen from all the seven seas come to have their hernias repaired look on it as the only method that can guarantee a permanent cure of really large scrotal herniae in heavy labourers

The disadvantages are mainly theoretical Silver salts may occasionally give a brown discoloration of the skin over the operation area and if sepsis appears the filigree cannot be extruded and must be removed.

8 THE TANNER SLIDE OPERATION

Tanner, Scott and del Oro have used the device of a vertical relaxing incision in the anterior rectus sheath deep to the external oblique aponeurosis to allow the conjoined tendon to be brought down without tension to Poupart s ligament Tanner guards against subsequent weakness of the outer part of the rectus sheath by attaching the outer leaf of the incision in the sheath to the underlying muscles by a few interrupted stitches

I use a short relaxing incision, not more than an inch long in the lower end of the rectus sheath to facilitate closure of the canal at its pubic end in old standing direct herniae where the material at this point is inadequate I do not like larger relaxing incisions nor do I like detaching the new posterior wall from its normal anchorage on the medial side Robbing Peter to pay Paul is normal practice in finance and politics but it is seldom profitable in surgery

9 THE McVAY PRINCIPLE

Astley Cooper s ligament is a tough fibrous structure on the ilio-pectineal line It is compounded of many tissues of the periosteum of the innominate bone of the pectineus fascia thickened at the origin of the muscle of fibres from Gimbernat s ligament the insertion of the conjoined tendon and the insertion of the psoas parvus and of the transversalis fascia lining the pelvis It holds stitches well and McVay has recommended it as secure anchorage for the conjoined tendon and the transversalis fascia in reconstruction of the posterior wall of the inguinal canal

Astley Cooper s ligament belongs properly to the inguinal canal only in its medial inch, for the distance that the conjoined tendon is inserted into the ilio-pectineal line Lateral to this point it sweeps backwards as well as outwards and leaves the inguinal region to form the lateral boundary of the true pelvis At the point where the external iliac vein crosses it the ligament is a good inch deep to Poupart s ligament

The inner end of Astley Cooper s ligament may rightly be used to give a secure anchorage to the inner end of a reconstructed posterior wall to the canal Lateral to this point the internal oblique cremaster

and transversalis fascia can be *attached to the ligament only* by pulling them right out of their proper plane under considerable tension, and if the suture line is continued out as far as the internal ring the displaced muscles are forced down on the cord like a chopper

For the anchorage of free transplants of skin or fascia or of sheets of *foreign material such as nylon net or tantalum gauze where it is desired* to fix without tension a secure rampart to defend the abdominal end of an enlarged femoral canal Astley Cooper s ligament gives a secure hold

10 BLOODGOOD S FLAP OPERATION

The rectus sheath flap is often referred to as Bloodgood s contribu*tion to the Hopkins operation for repair of the inguinal canal anterior* to the cord published by Halstead in 1903 [1]

The same flap has been used as part of an operation of repair posterior to the cord by Bloodgood, and also by Downes and by Keynes In some illustrations of the operation as performed by Bloodgood *himself the rectus muscle fibres as* well as the sheath are shown as sutured to Poupart s ligament

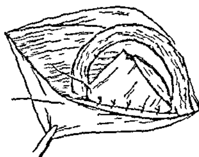


FIG 37 Bloodgood s operation

The posterior Bloodgood operation is a reinforced Bassini type of repair (Fig 37) *Two criticisms are suggested* the basic one of Gallie s experiments that a sheet transplant of *fascia sutured by its* edge does not gain a secure attachment and the practical one that the detachment of the anterior sheath of the rectus leaves a weak area at the outer border of the muscle protected only by transversalis fascia and made wider by the pull of the sutured flap

[1] W S Halstead *John Hopkins Hosp Bull* 1903 14 208

The use of the rectus muscle itself has nothing to recommend it A voluntary muscle pulled out of its normal line tends to atrophy and to make very poor fibrous tissue

11 TURNER'S FLAP OPERATION

Philip Turner of Guy s Hospital devised an operation to repair a stretched internal ring medial to the cord, by turning up a flap of fascia from the hip His account of the operation[1] is as follows The essential feature is that a pedicled flap of fascia lata with its base at Poupart s ligament is used for the purpose of diminishing the size of

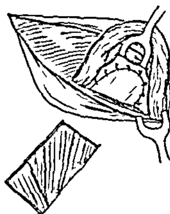


FIG 38 Turner s operation

the opening and strengthening the fascial boundary of the canal The flap is turned upwards beneath Poupart s ligament into the inguinal canal and is sutured to the margins of the gap which have been carefully defined at an earlier stage The original deep surface of the flap which was in contact with the muscles of the thigh looks forward, while the original superficial surface in relation with the fatty tissues of the thigh is now in contact with the extra-peritoneal fatty tissues at the back of the inguinal canal

The essential features of Turner s operation are shown in Fig 38

[1]*Guy s Hospital Reports* 1933 13 2 233

Twenty years ago I cited Turner s operation as a permissible method in difficult cases Twenty years have taught me the interdependence of all the fibrous planes of the body, and I look on any injury to or rough treatment of Poupart s ligament regrettable and any severance of its deep attachments as reprehensible Ever since the first vertebrate to get out of the water developed limbs to paddle through the slime limbed creatures have used a fibrous seal to close the gap where the abdominal muscles and the thigh muscles meet The security of this band which in man is Poupart s ligament seems to depend on little but faith and fibrous tissue

I shall refer to this point again in discussing femoral hernia Meanwhile I would discourage any operation that interferes with the deep attachments of the ligament

I should disapprove even more strongly of operations such as that of Henri Fruchaud of Aleppo in which he detaches the whole lower part of the external oblique aponeurosis and turns it up as a flap[1]

12 METHODS OF REPAIR ANTERIOR TO THE CORD HALSTED S OPERATION

The skin and external oblique aponeurosis are incised in the line of the inguinal canal and the flaps are dissected back widely to demonstrate the muscular layers The cremaster is incised in the line of its fibres and the cord is exposed but not lifted from its bed. The sac is identified dissected free from the other structures in the cord that lie behind it cleared up to the internal ring transfixed ligatured at its neck cut across and allowed to drop back.

The muscular layers are then imbricated in front of the cord. The lower flap of the cremaster is first drawn up under the internal oblique and conjoined tendon by a series of matress sutures of fine catgut that pick up the edge of the cremaster and then pass through the internal oblique from within outwards about an inch from its free border (Fig 39(*a* and *b*) These are tied The conjoined tendon is then sutured to Poupart s ligament by interrupted stitches of catgut Finally the incision in the external oblique aponeurosis is overlapped in a similar manner to the deeper layers the lower leaf being drawn under the upper one by a series of matress sutures (Fig 40)

[1]Fruchaud *Hernies de l'Aine* G Doin & Cie Paris, 1957

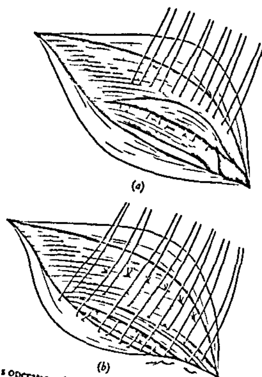


FIG 39 Halsted s operation Imbrication of the muscular layers in front of the cord

(a) The lower flap of the cremaster is being drawn under the internal oblique by a series of sutures

(b) The conjoined tendon is sutured to Poupart s ligament by interrupted stitches

The operation is sometimes modified by incising the rectus sheath vertically to allow the conjoined tendon to be brought to Poupart s ligament without tension or by cutting a flap of the rectus sheath in the manner associated with the name of Bloodgood and stitching that also to Poupart s ligament in front of the cord.

Foster s operation is a simpler form of the Halsted the conjoined tendon being brought down to Poupart s ligament as in Bassini s operation, but in front of the cord

Ferguson s operation is also similar to the Halsted, but he believed that in hernia there was a deficiency in the origin of the internal oblique

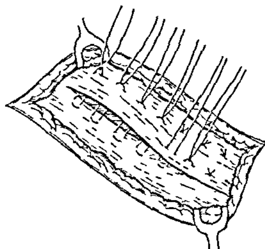


FIG 40 Halsted s operation Imbrication of external oblique aponeurosis

and transversalis muscles from Poupart s ligament For this reason he started his suture of the muscular layers to Poupart s ligament lateral to the point of emergence of the cord, and continued this suture two thirds of the way to the pubic spine but no farther

Babcock s operation was similar

It seems clear that anterior *repair is wrong in principle* In any but an early oblique hernia, the internal ring is stretched, and the cord is displaced inwards carrying the fibrous margin of the ring and the deep epigastric artery with it Anterior repair does nothing to restore the obliquity of the cord or to prevent its further displacement and the end result is a direct hernia passing through all layers of the abdominal wall close to the pubic spine

13 METHODS OF POSTERIOR REPAIR IN WHICH ALL LAYERS ARE USED IN THE REPAIR, AND THE CORD IS PLACED SUBCUTANEOUSLY

The best known example of such a method is the modified *Willys Andrews* operation described by Dewitt Stetten *After suture of the* upper end of the external oblique aponeurosis to Poupart s ligament the cord is brought out subcutaneously and the lower leaf is also sutured behind it to the upper leaf

This operation produces not a hernia but a short direct passage for the cord through which a hernia will almost necessarily follow The great bulk of the cord consists of large veins that vary in diameter from time to time, and it is impossible to construct a straight channel that will fit it so snugly that herniation is impossible yet in which obstruction of the bloodflow, leading to hydrocele or atrophy of the testicle is unlikely

14 REPAIR OF INGUINAL CANAL THROUGH AN ABDOMINAL APPROACH

(a) *Intraperitoneal* In the early days of abdominal surgery Annandale and Lawson Tait advocated an approach to the inguinal canal through a laparotomy incision. Later G P la Roque advised opening the abdominal cavity by a muscle splitting incision through the internal oblique and transversalis muscles about an inch above their lower margins after exposing the sac in the inguinal canal[1] He inverted the sac into the peritoneal cavity divided it, and sutured the peritoneum well above the neck.

(b) *Extra-peritoneal* Lenthal Cheatle[2] and A K. Henry[3] advocated an extra-peritoneal approach through a mid-line incision. The back of the inguinal canal and the internal ring can be reached with remarkable ease by gentle stripping of the peritoneum from the transversalis fascia Removal of the sac from the neck downwards without damage to the other structures of the cord is a very different matter Most surgeons who are familiar with the long and difficult dissection that is necessary to separate the sac from the veins and the vas by the inguinal approach would say that it is impossible

Professor Henry has contributed more of value to the study of anatomical approach in operative surgery than any living man, but his advocacy has not ensured any wide acceptance of this method It is very difficult to see any advantage in indeed to find any excuse for blind extraction of a hernial sac. The internal ring the fibrous gateway to the inguinal canal must be stretched if not torn, by dragging the whole of the sac through it

[1]*Surg Gyn & Obst* 1919 XXIX, 507
[2]*Brit Med Journ* 1921 2 1025
[3]*Lancet* 1936 1 53

CHAPTER 7

HERNIA BELOW POUPART S LIGAMENT

The first vertebrate to crawl out of the sea must have been a fish-like creature possibly allied to the Coelacanth, with paddles rather than limbs But the sinuous movements that drove the fish through the water were useless in the new element.

The paddles became limbs and because propulsion is more efficient than traction, the hind limbs became dominant in locomotion. Antero-posterior movements of the spine took the place of the lateral movements of the fish. The creature progressed by a series of leaps flexion of the trunk and the limbs bringing the hinder end forward on the ground extension transmitted this gain to the rest of the body The flexors of spine and hip worked together and had a common attachment to the front of the vertebral column.

The sealing of the gap between the anterior abdominal wall and the flexor muscles of the thigh is the basic anatomical problem of all quadrupeds It is solved by a blending of the lower edge of the abdominal muscular sheet with the fascial sheath of the thigh flexors In most creatures the contrast between the planes of the two muscular groups is less obvious than it is in human beings In reptiles and amphibia the lower fibres of the transversus muscle arise from the fascia over the iliacus and sweep downwards and inwards to gain a wide insertion into the sheath of the flexors and adductors of the thigh. In many monkeys a similar arrangement is seen. Poupart s ligament like the peroneus tertius in the foot is a typically human structure. It represents the fibrous seal that all quadrupeds have but the broad human pelvic girdle places it more nearly in the horizontal plane that it is in other animals So distinct is it from the flexors that come out from under it that anatomists have described it as made by the lower folded edge of the external oblique aponeurosis It is nothing of the sort All layers of the abdominal wall contribute to Poupart s ligament and in its outer third it receives a considerable contribution from the fascia iliaca.

In terms of conventional surgical anatomy Poupart s ligament is a ligament that bridges a shallow trough through which the flexor muscles of the thigh the iliacus psoas and pectineus and the neuro-vascular bundle of the lower limb emerge from the abdomen (Fig 41) It is anchored to the two margins of the trough to the anterior superior spine of the ilium and the spine of the pubis The inner anchorage is continued by Gimbernat s ligament which is merely the deeper fibres of Poupart s ligament fanned out along the ilio-pectineal line for more secure attachment Gimbernat s ligament is thus a triangular sheet

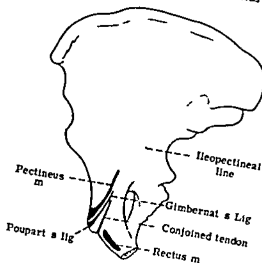


Fig 41

hose apex is at the pubic spine one of whose sides is continuous with Poupart s ligament and the other is attached along the inner end of the ilio-pectineal line and whose base is a free margin facing towards the sub-Poupart trough. On the ilio-pectineal line the attachment of Gimbernat s ligament lies between the insertion of the conjoined tendon medially and the tendinous origin of the pectineus (Astley Cooper s ligament) laterally

Poupart s ligament is securely attached at the two ends Above it is blended with the abdominal musculature Below it is continuous with the fascia lata of the thigh, and is held by this attachment in a slight curve convex downwards Behind it depends for its security which is for practical purposes absolute on fibrous anchorages The fascia lining

the abdomen is a continuous sheet that gains attachment to Poupart's ligament as it passes behind it The same fascia is continued into the thigh as the sheath of the iliacus and psoas so that Poupart's ligament is fixed to these muscles as they pass behind it The aorta and inferior vena cava are in front of the vertebral bodies and their branches, the iliac vessels lie in front of the fascia covering the posterior muscles When they reach the point where they pass under Poupart's ligament to become the common femoral artery and vein, they meet the iliacus fascia sweeping up to join the transversalis fascia and they carry a prolongation of it with them as the femoral sheath The femoral sheath is attached also to the pubic fascia behind and this fascia, dipping down in the interval between the pectineus and the psoas muscles is fixed to the iliopectineal eminence and to the capsule of the hip joint. Thus a strong fascial band embracing the femoral vessels anchors the mid-point of Poupart's ligament to the framework of the pelvis behind (Fig 42)

While the moorings of the ligament are indefinite they are remarkably secure and the only sub-Poupart hernia that is encountered except as a great rarity is one through the crural canal—that is a femoral hernia

The textbook description of the crural canal is that it is the innermost of three compartments of the femoral sheath the arterial the venous and the crural canal It is said to be ½ to ¾ in long to have an

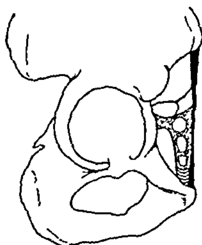


Fig 42 The fibrous attachments of Poupart's ligament to the pelvis

opening above bounded by Gimbernat's ligament medially Poupart's ligament in front the origin of the pectineus behind, and the femoral vein laterally to be closed above by a fibrous washer in the sub-peritoneal fat—the septum crural—to be closed below by the fusion of its medial wall with the femoral sheath to contain fat and a lymph gland, the gland of Cloquet and to transmit a lymphatic channel running from the deep femoral to the external iliac group of glands

To the conscientious dissector the crural canal is an anatomical fairy tale In the dead body the femoral vein is collapsed and a blunt instrument can easily be pushed to its inner side to make a channel In ife the vein is full and during activity the flow it is required to transmit nay be increased up to twenty times Room must be allowed under the gid sub-Poupart canyon, and is provided by this mythical canal for e vein to increase its cross-section to carry this augmented flow

Certain anatomical facts must be reiterated since they have a bearing on the surgery of femoral herniae

First the canal of a femoral hernia begins and the neck of a femoral hernial sac lies at the free edge of Gimbernat's ligament This level is ½ in. above Poupart's ligament and 1½ in. above the saphenous opening The sac cannot therefore be controlled up to its neck by any form of truss The junction of the neck of the sac with the parietal peritoneum cannot be reached from below without gross trauma nor can the crural opening be closed securely by any method of suture from the thigh.

Secondly Poupart's ligament depends for its security on a wide system of fascial anchorages Any damage to those anchorages such as that caused by dragging a femoral sac from the thigh to the abdomen is apt to leave a weakness for which subsequent repair cannot adequately atone

Thirdly Poupart's ligament is a long tendinous span anchored to bone at both ends Depression at one end will depress the whole and compress the vascular channels that pass under it Therefore any method of closing the channel of a femoral hernia from above by fixing the inner end of the ligament to the pubic bone by staple or suture is unsound.

Aetiology of femoral hernia

Femoral hernia is the classical example of an acquired hernia Hamilton Russell who established the congenital nature of oblique

inguinal hernia, thought that femoral hernia was also congenital[1] Embryological research dissections in the foetus and operations on the new born do not support such a view Two causes seem to be important repeated strain and adiposity Fat and fascia in the body are alternative aspects of the same tissue and mutually exclusive

Femoral hernia *is six times as common in women as in men, but it* is certainly not as is sometimes stated the commonest hernia in women Inguinal hernia is twice as common In men one femoral hernia is found to twenty inguinal in women one to three The difference is accounted for entirely by the strain of child bearing The incidence in childless women is about the same as in men Femoral hernia is rare in childhood but it has a similar incidence in both sexes

Femoral hernia then is a labour casualty It is commoner in women of civilized races because they bear their children in bed after a period of recumbency that is with the venous compartment of the femoral sheath comparatively empty and because parturition is with them a more strenuous affair than it is with savages or animals

Diagnosis of femoral hernia

In theory a femoral hernia is covered by nine layers of which every alternate one is fat—skin, subcutaneous fat cribriform fascia fat in the saphenous opening femoral sheath fat in the crural canal septum crurale extra-peritoneal fat and peritoneum. It is well to retail this *useless information because it emphasizes two important practical* points that a femoral hernia is never reducible and that at operation a surprising number of layers must be divided in turn before the true sac is reached The bulk of a femoral hernia consists of coverings rather than sac and though it is sometimes (but not often) possible to reduce the contents of the sac into the abdomen by *manipulation* the lump in the saphenous opening remains almost unchanged

The size of the lump tends to increase with the duration of the hernia The neck of the sac which lies in a rigid channel tends to remain a tube of small diameter but the fundus dilates as more contents enter it and repeated obstruction to their blood supply *leads to repeated* exudation of fluid. A large femoral sac comes to resemble a balloon on a stalk. *The coverings increase in thickness as the sac enlarges*

A femoral hernia appears at the saphenous opening in the deep

[1] *Surg Gyn Obst* 1926 43 147

fascia and as it enlarges tends to remain there If it migrates it tends to extend upwards over the inner end of Poupart s ligament The probable explanation of this tendency is that the hernia is forced by its surroundings into a course first downwards and then forwards and each further protrusion follows the same curved course

The differential diagnosis of a femoral hernia will depend on whether it is reducible or not

The common femoral hernia is irreducible but symptomless The sac contains nothing but a tag of adherent omentum and the outer coverings are fat laden and bulky There is no impulse on coughing Such a swelling is merely a rounded elastic tumour in the inner half of Scarpa s triangle that must be distinguished from an enlarged lymph gland and a lipoma the only conditions which it resembles

The distinctive feature of the hernia is that it has a neck and the neck passes backwards below Poupart s ligament and medial to the femoral vessels When the lump is moved about this deep attachment becomes obvious A lymphatic gland lies in the plane of the superficial fascia and in that plane it can be moved to an approximately equal extent in all directions A single enlarged inguinal gland is in any case unusual A lipoma is in the subcutaneous fat and can be lifted off the deep fascia A femoral hernia can be moved in circles within the range allowed by its stalk like the joy-stick of an aeroplane in most cases the stalk can be traced to Poupart s ligament

A reducible femoral hernia may be quite clearly a hernia that is it is reduced by manipulation and returns not immediately but after coughing or straining Reduction and reappearance are accompanied by the gurgle of intestine and the swelling is resonant to percussion. The only difficulty in such a case is the distinction between a femoral hernia lying over the external ring and an inguinal hernia

The distinction between femoral and inguinal hernia rests on two points on the relation of the swelling to the pubic spine and whether the swelling after reduction reappears above or below Poupart s ligament An inguinal hernia that has reached the external ring overlies the pubic spine but the spine can be felt by putting a finger below and lateral to the swelling and displacing it inwards In femoral hernia the pubic spine can be felt only by a finger placed above and medial to the swelling After reduction of a hernia whose nature is in doubt a finger should be kept on the inner end of Poupart s ligament while the patient coughs It can then be determined whether the swelling

reappears from below the ligament that is from the crural canal or above it from the inguinal canal

Two reducible swellings in Scarpa s triangle saphenous varix and psoas abscess may be mistaken for femoral hernia by the inexperienced or over confident Both are reducible swellings below Poupart's ligament but neither has the true characters of a hernia Both appear in the erect position and disappear on recumbency and neither has the firm rounded outline of a hernia gives a gurgle when handled or is resonant to percussion

Saphenous varix a venous swelling large enough to resemble a femoral hernia gives a bluish colouring to the overlying skin It rarely exceeds the size of a half walnut and it reduces so easily that its outline cannot be felt It disappears not merely with finger pressure but spontaneously on lying down On coughing a fluid thrill can be felt over the swelling

It may sound ludicrous to suggest that a psoas abscess can be mistaken for a femoral hernia but the mistake has been made repeatedly in the past by surgeons of considerable experience and it is being made even more often today when psoas abscess—indeed any form of cold abscess—is rarely seen by the student The patients who are seen with these dissecting psoas abscesses are not the textbook cases of Pott s disease—children or young adults with pale wasted faces and a hunch back—but old men and women suffering from the periosteal form of this desease affecting many vertebrae but destroying none They complain of pain and stiffness in the back that are no worse than the common senile rheumatism due to osteo-arthritis They come to hospital to report a swelling in the groin that has appeared in the last few weeks and they do not mention their backache

The careful surgeon aware of the saying that a spot diagnosis is the quickest way of reaching a wrong decision will notice that though the swelling is obviously below Poupart s ligament it lacks that sharp definition that is typical of a femoral hernia A femoral hernia looks and feels like a rubber ball under the skin A psoas abscess cannot be defined. If it is small the only kind that resembles a femoral hernia in any way it lies lateral to the femoral artery If it is large enough to have ruptured the psoas fascia and to point medial to the vessels it is slack and diffuse and feels like a cold abscess and not a hernia A second swelling can be seen and felt in the iliac fossa and fluctuation can be demonstrated between this swelling and that in the groin.

THE OPERATIVE TREATMENT OF FEMORAL HERNIA

The operations for femoral hernia are usually classified as high or low that is above or below Poupart's ligament

The low operations are as old as surgery itself for man's natural instinct is to tackle any problem in the most direct and simple manner and only later to seek improvements The only variants are in the incision and in the means adopted to close the canal and these are all minor modifications of the same basic approach

The high operations imply an approach through the inguinal canal The principle is at any rate as old as antiseptic surgery It has been described in many countries by many surgeons of whom the first appears to have been Annandale of Edinburgh The inguinal operation in its modern form is usually given the names of Gordon and Lotheissen It has on the whole been remarkably successful but there has been a tendency in recent years to decry it owing to occasional recurrence and to return to the low operation.

Being old enough to remember as a student the time when the high operation was just coming in, and the low one owing to its numerous recurrences was fast going out I have no patience with the attempt to rehabilitate the anatomically unsound and practically unsuccessful operation from the groin. Recurrences after the Lotheissen operation are uncommon, but they are not unknown. They can however be traced to two errors that can and should be avoided firstly to the dislocation of Poupart's ligament by dragging a bulky sac under it leading to a femoral recurrence secondly to the division and imperfect repair of the transversalis fascia where it forms the posterior wall of the inguinal canal leading to a direct inguinal hernia in place of a femoral one

Since the Second World War the extra-peritoneal approach to the femoral canal first proposed by A K Henry in 1936 has gained increasing acceptance In my opinion it should now become the standard method

Henry[1] used a mid-line incision. His first case was the unusual one of bilateral femoral hernia and the approach gave equally ready access to both femoral canals He stripped the unopened peritoneum from the

[1] *Lancet* 1936 I 531

sides of the bladder and from the pelvic wall and obtained a view of both sacs which stood out from the peritoneum as he describes it like horns from a snail MacEvedy[1] used an approach from the outer border of the rectus which gives even more direct access to the neck of a femoral sac

From a general consideration of the anatomy and aetiology of femoral hernia it should be clear that both the high and the low operations have faults The high operation gives a direct access to the neck of the sac and the commencement of the canal but not to the fundus or its coverings *The reverse is true of the low operation* A combined approach is essential

I THE STANDARD OPERATION
(Modified MacEvedy)

MacEvedy used a vertical approach near the outer border of the rectus at its lower end. A vertical incision through the skin is unsightly A vertical incision through the rectus sheath has the mechanical defect of dividing aponeurotic layers across their line of stress I have modified the operation by using a crease incision for the skin and a muscle splitting approach for the deeper layers

The skin incision

The incision is made in the skin crease above the groin, as in the standard operation for inguinal hernia but it should extend from the *mid-line to the point where the crease crosses* Poupart s ligament in its outer third After division and ligature of the small vessels in the superficial fat the incision is deepened to the external oblique aponeurosis *Dissection is continued in this layer till a wide area of the aponeurosis* down to Poupart s ligament is exposed.

Exposure of the sac

The lower flap of the incision is held up with two Lane s tissue forceps that take all layers an inch away from the edge The bulge of the hernia will be seen under the *fibrous layer of the deep fascia* immediately below Poupart s ligament and a stroke with the knife dividing this layer over the swelling allows it to extrude (Fig 43) The

[1] *Ann R. Coll. Surg* 1950 7 484

swelling which consists largely of fatty coverings is seized with toothed dissecting forceps and cleared with a few strokes of the closed Mayo scissors from the superficial fascia that surrounds it back to the point where it disappears under Poupart's ligament

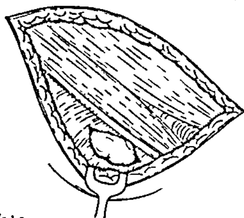


Fig 43 Modified McEvedy operation Exposure of the sac

An assistant holds the other side of the fatty swelling with toothed forceps and the surgeon cuts boldly into it with scissors till he reaches the sac, which is usually quite small in relation to its coverings The coverings are stripped off the sac down to Poupart s ligament They cannot be identified seriatim, but all of them come out of the femoral canal and they should on no account be dragged back through it They are cut off with scissors round the neck of the sac A few small vessels will require ligature

The sac is now opened and its interior inspected. The usual content is a fringe of omentum that has become fibrous and adherent from long residence and repeated vascular obstruction. The omentum is pulled down further ligatured and cut off and the stump is pushed back into the abdomen The sac is clamped flush with Poupart s ligament cut off and the neck is ligatured with No 30 linen thread the ligature being left long

Abdominal exposure of the neck of the sac

The external oblique aponeurosis is split in the line of the pillars and the upper leaf only of the aponeurosis is cleared by blunt dissection

from the underlying internal oblique muscle to the point where the two fuse about an inch medial to the outer border of the rectus

The deep layer of the rectus sheath thus exposed, is incised in the line of its tendinous fibres which are here seen to run almost transversely The cut will extend 1 in to 1½ in. before it reaches the muscular fibres of the internal oblique and it will expose the underlying rectus muscle (Fig 44) The cut is now carried outwards for another inch through the internal oblique separating rather than cutting its fibres, and is deepened in the same line through the transversalis which is here purely tendinous A tenuous layer of transversalis fascia only covers the extra-peritoneal fat

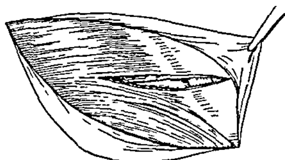


FIG 44 Modified McEvedy operation Division of rectus sheath

The rectus muscle is displaced medially and the extra-peritoneal fat is thus exposed for a width of 2 in to 2½ in immediately above the opening of the femoral canal A few touches with a finger or a small swab will expose the neck of the sac disappearing into the canal (Fig 45) If the neck is not immediately obvious a gentle pull on the ligature in the saphenous opening will immediately reveal it

The neck carrying the ligature is drawn into the abdomen and inspected. If there is any doubt about the complete reduction of the contents of the sac the neck can now be opened as widely as is necessary and closed again by ligature In most cases where a ligature is used in surgery the surgeon is careful to include as little as possible in its grasp since all tissues distal to the ligature die and are converted into fibrous tissue In ligaturing the neck of a femoral hernia, this is just what the surgeon desires He ties the neck flush with the peritoneum and removes the temporary thread ligature applied in the groin but

he does not cut off the redundent tissue A good blob of fibrous tissue lying between the peritoneum and the femoral canal is a consummation devoutly to be wished

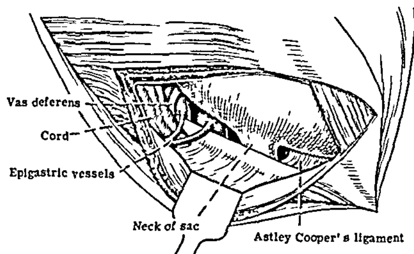


FIG 45 Modified McEvedy operation Exposure of the neck of the sac

The empty femoral canal is further protected at its abdominal end by a few sutures bringing the conjoined tendon down to the iliopectineal line (Astley Cooper s ligament) as far as the external iliac vein. By the MacEvedy approach this can be done easily, safely and without injuring the fascial posterior wall of the inguinal canal

Closure of the wound

The peritoneum is allowed to fall into place and the rectus muscle is allowed to resume its line The incision in the rectus sheath is closed with interrupted sutures of catgut and the outer part is similarly closed a few separate stitches being inserted into the transversalis layer before the internal oblique layer is sutured The external oblique aponeurosis is approximated with a continuous catgut suture

If the hernia was a large one its removal has left a gap in Scarpa s triangle This should be obliterated by a few stitches of fine catgut drawing the fatty fascia together

The main incision is closed as in inguinal hernia by fine nylon

sutures through all layers of skin and superficial fascia tied over an anchor dressing after the skin edges have been approximated with Michel clips

Alternative treatment of the femoral ring

The ideal *treatment of a femoral hernia is the closure of the femoral* canal without disturbing in any way the normal moorings of Poupart's ligament In an early femoral hernia the crural canal is occupied by a peritoneal tube and its coverings the structures that having escaped into Scarpa's triangle expand into the familiar hernial swelling but that in the canal fit the inner compartment *snugly, in fact make the ideal* living plug

In such a hernia the peritoneum can be opened just above the femoral opening and the neck of the sac can be inspected from within. If the contents have been reduced the peritoneum can be cut round the femoral opening leaving the neck *in situ* and the opening into the peritoneal cavity can be closed by an encircling ligature that leaves a fibrous plug as a further protection against recurrence In such a case *there is no need to suture the conjoined tendon or to disturb the* inguinal canal

2 THE INGUINAL OPERATION

The operation as originally described by Lotheissen, who recorded twelve cases repaired by this method in 1898[1] has been modified since *only in unimportant details*

The incision usually recommended is one parallel with the Poupart's ligament but a little lower than the usual inguinal one in order to provide ready access to the sac in Scarpa's triangle *The sac is first* identified stripped of its coverings emptied and ligatured at its neck as in the standard operation.

The inguinal canal is next opened by an incision in the external oblique aponeurosis extending into the external ring The flaps are *turned back, the cremaster is incised* and the cord or round ligament is lifted from its bed to expose the posterior wall of the canal This wall which consists chiefly of transversalis fascia in the middle third of the canal is incised with the knife above *and parallel to Poupart's*

[1] G Lotheissen *Zentralbl Chir* 1898 25, 548

ligament taking care to avoid the deep epigastric vessels laterally and their pubic branches that run along the ligament The extra-peritoneal fat exposed by this incision is pushed upwards away from Poupart s ligament with a small gauze swab till it is tied by the neck of the sac entering the femoral canal This peritoneal neck is defined by blunt dissection, and carefully worked out of the canal into the inguinal incision. When free it is pulled up into the wound, inspected at its inner side for adherent bladder opened and cleared of any omentum still adherent Finally it is ligatured flush with the peritoneum and cut away (Fig 46)

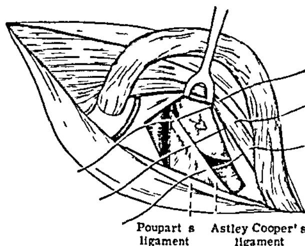


FIG 46 The inguinal approach for femoral hernia (Lotheissen)

The weak spot under Poupart s ligament from Gimbernat s ligament to the external iliac vein, is protected from within by broadening the insertion of the conjoined tendon to the ilio-pectineal line in a lateral direction, that is by attaching it to Astley Cooper s ligament by interrupted catgut sutures While an assistant with a flat spatula retracts the conjoined tendon and peritoneum together the surgeon places the index finger of his left hand firmly on the ilio-pectineal line and slides it outwards laying bare Cooper s ligament as a glistening tendon and pushing the iliac vein out of harm s way Three or four stitches of No 1 catgut on a small stout curved needle are inserted through the conjoined tendon ¼ in from its free margin and through Cooper s ligament The first should be next to Gimbernat s ligament

the last just medial to the femoral vein, and *the assistant must remove* the spatula to give access to the conjoined tendon and re-insert it to expose Cooper's ligament All the stitches are put in before any are tied.

The posterior wall of the inguinal canal having been damaged by the operation the internal oblique and transversalis fascia should be sutured to Poupart's ligament as in Bassini's operation. The external oblique and skin are closed in the usual manner

Modifications in the case of large herniae

In old standing femoral herniae or in those that have recurred after repair the weak area under Poupart's ligament medial to the femoral vein *may* be so large that suture of the conjoined tendon to the iliopectineal line behind the aperture cannot offer sufficient security against recurrence Those who share with me the view that Poupart's ligament should not be loosened or displaced have the choice of several alternatives Owing to the proximity of the femoral vein the use of metal or any rigid structure is inadmissible

(*a*) *Fascial suture* The plantaris tendon or one or more fascial strips taken from the thigh or the external oblique aponeurosis are darned backwards and forwards from Poupart's ligament to Astley Cooper's ligament the darn starting at the pubic spine and continuing outwards till no more than sufficient room is left for the femoral vein The method implies not the drawing down of Poupart's ligament to the pubic crest but the construction of a stronger and wider Gimbernat's ligament

(*b*) *Reinforcement of the conjoined tendon by an aponeurotic layer*

i The Willys Andrew's method The upper leaf of the external oblique aponeurosis may be sutured with the conjoined tendon to Cooper's ligament behind the cord.

ii The Bloodgood rectus sheath flap (see page 84) The flap is sutured to Cooper's *ligament as far as the point where it is* crossed by the vein, in much the same way as it is sutured to Poupart's ligament in the Halsted operation

(*c*) *Reinforcement by free transplants* of living material derma or fascial sheets or of inert fabrics such as *nylon or orlon mesh or gelatine* sponge

(*d*) *Plugging the canal*

i By the sac, turned inside out and flattened over the abdominal aspect of the canal like the head of a rivet[1]

ii By auto transplants of fat or muscle

3 THE LOW OPERATION

While the low operation is traditional rather than scientific it remains the choice of the inexperienced surgeon who is forced to operate without assistance It is sometimes advisable when speed and minimum interference are important and it may be the best operation in some cases of strangulation

The skin incision

An incision directly over the swelling has many advantages but the vertical incision described in many textbooks should be abandoned The crease incision advised for inguinal hernia and for the high operation for femoral hernia is entirely satisfactory but one below Poupart s ligament and lying in the crease that is made by flexion of the hip joint is better (Fig 12)

Isolation and ligature of the sac

The steps are similar to those described in the standard operation, but in the low operation the sac itself is dissected as high as possible by pulling on it while the layers round it are dissected off with Mayo scissors and pushed back with their closed points When it appears that the actual neck has been reached, the sac is opened and emptied the neck is tied as near as possible flush with the peritoneum, and the stump is allowed to retract into the abdomen.

Closure of the femoral canal

Many methods have been recommended but none are entirely satisfactory Most rely on the suture of Poupart s ligament or of Poupart s ligament and the falciform ligament to the pectineus fascia

Marcy the real father of hernia surgery used a simple purse-string starting at the inner end of Poupart s ligament picking up Gimbernat s

[1]Saunders Melville *Brit Med Journ* 1935 I 467

ligament the pectineus fascia and as much of the femoral sheath as appeared to be safe and emerging through Poupart s ligament near to its point of entry (see Fig 47) Bassini used interrupted sutures the first two or three passing from Poupart s ligament to the pectineus fascia others from the falciform ligament to the same fascia (see Fig 48)

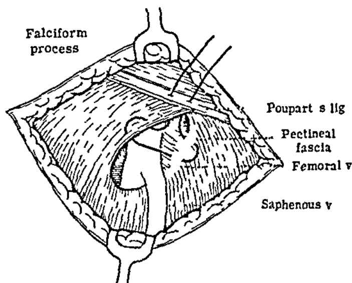


Fig 47 Closure of femoral canal from below Marcy s method

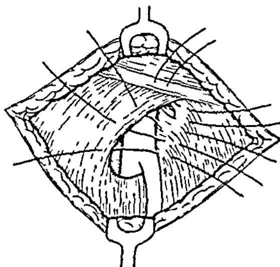


Fig 48 Closure of femoral canal from below Bassini s method

Lockwood using a curved hernia needle on a handle and protecting the vein with a finger in the canal inserted stitches uniting the inner end of Poupart s ligament to Astley Cooper's ligament Other surgeons attempted to anchor Poupart s ligament directly to bone by a metal staple (Roux) or by sutures passed through drill holes in the pubic ramus (Nichol)

It will be realized that the low operations have no place except as emergency procedures The sac can never be cleared from below sufficiently high to leave a smooth undimpled peritoneal surface after ligature All methods of repair of the canal from the thigh fail to construct an adequate protection of the hernial passage at its commencement and most of them compress the femoral vein. The mere attempt to reach Astley Cooper s and Gimbernat s ligaments through the femoral opening involves a damage to the fibrous attachments of Poupart's ligament that is quite inexcusable

PREVASCULAR HERNIA (Narath s Hernia)

Apart from femoral hernia the only hernia encountered below Poupart s ligament is the prevascular hernia a lesion due to the rupture or stretching of the fascial bands that normally anchor Poupart s ligament to the structures that lie behind it. Through the weak area that results the peritoneum bulges into the thigh between the ligament in front and the femoral vessels and flexor muscles behind. The hernia was first described by Professor A Narath of Utrecht in 1899 [1]

Prevascular hernia is usually a result of congenital dislocation of the hip but it occasionally follows a traumatic dislocation. The upper end of the femur displaced from the acetabulum, carries the insertion of the flexor muscles backwards and away from the inguinal ligament that overlies them

Apart from its association with dislocation of the hip prevascular hernia is seen in the aged sick where repeated coughing has slowly forced a passage between Poupart s ligament and the wasted muscles behind it I have encountered it once in a young and healthy man, in whom the cause of the weakness was quite inexplicable He was a hospital official and he refused to wear a truss and insisted on operation.

[1] A Narath *Arch f Klin Chir* 1899 59 396

The prevascular hernia is a wide bulge without a neck Strangulation is unlikely and control by a truss is satisfactory

Operative treatment of prevascular hernia

An attempt to re-attach Poupart's ligament by artificial means to the tissues from which it has come adrift is unlikely to succeed A sounder plan is to substitute a tough and unstretchable sheet for the continuous layer of fascia iliaca and transversalis that normally lines the bottom of the abdominal cavity outside the peritoneum.

In the case mentioned the only one that I have myself repaired, I approached the abdomen through the usual crease incision. I split the external oblique aponeurosis in the line of the inguinal canal and turned back the flaps I then divided the internal oblique and transversalis muscles in the line of the fibres of the former roughly parallel to Poupart s ligament and above and parallel to the ilio-inguinal nerve Having exposed the extra-peritoneal fat I pulled the extruded pouch from under Poupart s ligament and without opening it cleared the peritoneum from the abdominal muscles in front and from the iliacus and psoas muscles and from the external iliac and spermatic vessels behind

I took a square of skin 4 in by 3 in cut like a Wolff graft from the abdominal wall and laid it with the superficial surface facing the extra-peritoneal fat on the defect The skin square was folded on itself about an inch from the long edge The fold was laid along Poupart s ligament the wider flap covering the iliac fossa the narrow flap lying beneath the abdominal wall The posterior flap was tacked with a few catgut stitches at the edges and corners to the fascia covering the iliacus and where it hung over the rim of the pelvis to the obturator fascia The anterior flap was tacked in a similar way to the back of the transversalis muscle

The incision in the deeper muscles was closed with interrupted sutures of catgut and the external oblique with a continuous suture

Healing was uneventful and the patient at any rate was satisfied with the result Had I the same operation to do again I should use nylon net instead of skin, as I have seen too many complications—chiefly infective—following the use of dermal implants in the inguinal canal

CHAPTER 8

Herniae in the Rectus Sheath

The rectus sheath is the tendon of insertion of the lateral muscles of the abdomen, and all three contribute to it The external oblique aponeurosis passes in front of the rectus muscle throughout its length and joins the deeper layers a short distance medial to its outer border The internal oblique and transversalis muscles fuse at the outer border of the rectus in a common tendon. From the costal margin to a point half way between the umbilicus and the pubis this fused tendon splits into two layers half of it going in front of the rectus muscle the other half behind Below this level all the combined internal oblique and transversalis tendon passes in front of the rectus Thus the posterior sheath of the rectus in so far as it is tendinous ends at this level in a cresentic fold, the fold of Douglas below it the posterior sheath is formed of transversalis fascia only

The pull of the lateral muscles being transverse the tendinous fibres in the rectus sheath are arranged for the most part transversely with few interlacing fibres to bind them together Incisions made transversely in the rectus sheath are almost self-approximating after suture while vertical ones hold stitches badly Only where the fibres of the internal oblique and transversalis are blended at the outer border of the rectus and where those of the two sides meet in the mid-line is there an interlacing that forms a tough feltwork The linea semilunaris and the linea alba are the two strongest parts of the anterior abdominal wall

The unbilicus marks the centre and the transitional point of the rectus sheath Above it the rectus muscle is divided by three tendinous intersections that are attached firmly to the sheath in front but hardly at all behind The muscles are separated in the mid-line by a gap varying from a $\frac{1}{4}$ in to $\frac{1}{2}$ in. wide a gap bridged by felted aponeurotic strands running from one sheath to the other Below the umbilicus the recti are in contact separated only by a thin fibrous septum.

On the posterior surface of the anterior abdominal wall the umbilicus marks the meeting point of three peritoneal folds drawn out by the fibrous cords representing the obliterated placental vessels as they are left behind in the process of growth. The obliterated *umbilical vein* becomes the round ligament of the liver that runs from the umbilicus upwards and backwards slightly to the right of the mid-line to enter the porta hepatis of the liver The round ligament drags back a cresentic fold of peritoneum the falciform ligament that partly divides the epigastric compartment of the peritoneal cavity into two The two obliterated hypogastric arteries (the remains of the umbilical arteries) form less prominent folds on either side of the mid-line running from the side of the bladder to the umbilicus These three folds are often loaded with fat At the umbilicus itself the peritoneum is firmly fixed to the abdominal wall

The umbilicus is the scar left by the sloughing of the umbilical cord after birth It marks the spot where a series of remarkable changes have taken place during the development of the foetus At about the seventh week the embryo which is then 5 mm long is attached by a short broad stalk to an 'umbilical hernia' larger than itself This hernia continuous with the abdominal cavity and lined with the same coelomic membrane contains the yolk sac and the fundus of the bladder, known as the allantois At about the 10 mm. stage the mid-gut loop leaves the abdominal cavity to enter the umbilical annexe forced to some extent by the rapid development of the mesonephros that is taking place in the abdominal cavity at the time While the mid-gut loop is in the extra-abdominal coelom the yolk sac empties rapidly and the vitelline duct with which it communicated with the alimentary canal is reduced to a fibrous cord attached to the lower ileum The gut increases in length and the division between small and large intestine is marked by the appearance of the caecum Towards the end *of the third month when the embryo is between 35 to 40 mm. long* the gut returns fairly rapidly to the abdominal cavity between the tenth and eleventh weeks The extra abdominal coelom is sealed off and is absorbed together with the remains of the vitelline duct and the allantois For the remainder of foetal life the umbilicus transmits only the placental vessels

At birth the cord which contains the umbilical vein and the two umbilical arteries embedded *in Wharton's jelly is covered* by skin for about ½ in. After ligature the part outside the abdomen sloughs and

the scar is rapidly covered by skin The vessels thrombose as far as the next functional channel within the abdomen and the clot in their lumen is converted into fibrous tissue by the ordinary process of repair During the first fortnight after birth the umbilical scar consists of a firm fibrous ring part of the rectus sheath surrounding a space filled by organizing blood clot a substance that is by no means strong

UMBILICAL HERNIA

Three varieties of hernia occur at the umbilicus—the congenital the infantile and the adult Of these only the second is truly umbilical The congenital herniae are not umbilical because they arise before the umbilicus is formed The adult herniae are for the most part protrusions through the linea alba above the umbilicus that is they are para-umbilical

I CONGENITAL UMBILICAL HERNIA

(a) Complete Exomphalos

This rare abnormality which is said to occur in about one birth in 10 000 is due to the failure of the mid-gut loop to return to the abdominal cavity in the tenth week It may be associated with other congenital defects such as spina bifida

Exomphalos is seen only in the newly born Unless treated within the first few hours by surgery it is not compatible with life

The abdominal wall appears to be replaced by a grey translucent dome through which the underlying viscera can be dimly seen The cord is attached to the summit of the dome The true abdominal wall lies well back in the flanks at the side of the swelling and its edge is marked by the sudden transition from pink skin to grey Wharton s jelly The coverings of the swelling are amnion, Wharton s jelly and extra-coelomic peritoneum The contents are the parts derived from the mid-gut loop the small intestine and the proximal colon, together with structures derived from the fore gut and the hind gut that have been extruded later The greater part of the liver and portions of the stomach and pelvic colon are usually in the hernia and they are seldom normal The liver which has not been moulded during develop-

ment by the pressure of adjacent organs is a globular mass the mid-gut loop is unrotated and unfixed, and a Meckel s diverticulum is usually present

The coverings of an exomphalos derive their blood supply from the umbilical cord they therefore die at the birth of the infant and slough shortly afterwards Unless the abdominal cavity can be closed with living tissue death from peritonitis is inevitable Fortunately the abdominal wall is not deficient but merely displaced

Operation An incision is made all round the swelling exactly at the line where skin joins Wharton s jelly Every bit of skin must be preserved since the re-establishment of skin-cover is the essential part of the operation

The skin edges are undercut and dissected back on each side to expose the aponeurotic layers The abdominal cavity is then opened and the hernial coverings are rapidly separated with the fingers from the underlying viscera which are covered with warm moist swabs as they are exposed The edges of the living abdominal wall are defined on each side seized with a row of Allis forceps and pulled forward A series of tension sutures of stout nylon, guarded with an *inch of fine rubber tubing are passed from one side to the other through* skin and abdominal wall about an inch from the edge of the defect and *their ends are clamped*

The edges of the aponeurotic defect are then approximated by closely spaced interrupted sutures of No 1 catgut *If the child is in* good condition the rectus sheath may be opened throughout its length on each side so that the closure is in two layers *If speed is* important one layer will suffice

The skin edges are approximated by fine nylon sutures and the tension sutures are tied

By one of those curious coincidences which are common in surgery the only two cases of exomphalos that I have seen were admitted into the same ward at Guy s Hospital within six hours of each other the one under Mr R. P Rowlands the other under Mr Lancelot Branley The first was operated on by me as Surgical Registrar and was later shown at the Clinical Section of the Royal Society of Medicine[1] He developed a year later bilateral inguinal herniae which were also repaired In 1932 he was a healthy boy of 12 with a sound abdominal wall

[1]W H Ogilvie *Proc Roy Soc Med* Dec 19 1

The second case already had peritonitis on admission and died a few hours afterwards

(b) Congenital hernia into the cord

In this type of hernia the mid-gut loop has returned to the abdomen in the normal way but the extra-coelomic pouch of peritoneum has remained patent in whole or in part A peritoneal sac extends for a variable distance from the abdominal cavity into the root of the umbilical cord which may be of nearly normal appearance or a little wider than normal

The importance of this hernia lies in the risk that a loop of bowel in the sac may be included in the ligature applied at birth. Even if the bowel is not injured or if there is no bowel in the sac the coverings of the sac are not viable and when they slough the way will be open for infection to spread to the abdominal cavity

Every case should be operated on as soon as the abnormality is detected The need as in exomphalos is to close the opening into the abdominal cavity with viable tissues According to the size of the defect the repair of the muscular layers may be vertical as in exomphalos or transverse as in the Mayo operation in adults

2 INFANTILE UMBILICAL HERNIA

An infantile umbilical hernia is a defect acquired during the first few days of extra-uterine life It is due to stretching of the newly formed scar before it is consolidated and it is therefore not seen during the first few days after birth nor is it likely to appear after the second month Some factor causing an increase in abdominal pressure either constant or intermittent, is usually to blame Such causes as crying coughing constipation, tympanitis or phimosis are common in the new born

The fibrous ring formed by the rectus sheath is usually intact and unstretched and the hernial protrusion is a small knob that is empty when the child is lying down and not straining Infantile umbilical herniae rarely strangulate They can be retained by a simple pad and with this treatment the majority are cured in a year or eighteen months Umbilical herniae are almost the rule in African infants and quite uncommon in African adults

Operation If the hernia is still obvious at the second year it is

unlikely to close spontaneously and operation at some convenient time is advisable

The incision To remove the umbilicus in a small child is inexcusable Children are cruel little savages ready to combine in mass attack on the timid and the defenceless They often see each other naked and the child without an umbilicus is taunted unmercifully For psychological if not for surgical reasons the umbilical scar must be preserved

The incision should be made in the short transverse crease that will be found crossing the epigastrium a short distance above the umbilicus The incision is carried down to the aponeurotic layer and the lower flap is then dissected further in this plane In most cases the little sac will come out of the fatty layer, if it does not the dissection is carried across its neck and beyond to 1 in. or 1½ in. below the opening The sac is held up and the fibres that surround the neck are divided carefully with a sharp knife More sac comes out until a good collar of peritoneum is free The sac is then opened, emptied, tied at its neck and cut off

Closure of the ring The defect in the aponeurotic layers is usually a small one and it can be repaired by simple suture A purse string suture of No 1 catgut is passed through the aponeurosis a few millimeters outside the margins of the opening and tied. This suture buries the stump of the sac and closes the hole The closure is further reinforced by three or four stitches placed in a vertical direction on each side of the hole so that when tied, they infold and bury the previous suture in a transverse direction

In the rare instances in which the hole in the aponeurosis exceeds ½ in in diameter it may be advisable to enlarge the opening in a transverse direction by cuts extending into the rectus sheath on either side and to overlap the opening by the Mayo method (see p 116)

The skin incision is closed by fine nylon sutures tied over an anchor dressing after the skin edges have been approximated with Michel clips

3 THE UMBILICAL HERNIA OF ADULTS

A few adult umbilical herniae are truly umbilical the recurrence in later life of a hernia that seemed to have been cured in infancy but that has been forced open by the pressure of repeated pregnancies or of ascites

The great majority are through the linea alba just above the um-

bilicus that is they are para-umbilical They occur for the most part in women Few are seen before the age of 25 and few appear for the first time after the age of 50 This age span corresponds to the child-bearing period and there is no doubt that umbilical herniae can be classed as a labour casualty Most of the women have had many children and in addition they are usually very fat In men adiposity is almost the only cause

The hernia appears to start as a transverse split in the linea alba just above the umbilicus possibly preceded by the extrusion of a lobule of extra-peritoneal fat between the tendinous fibres The sac at first is a simple pouch of peritoneum but as it enlarges it is unable to draw out further peritoneum from that lining the abdomen as do enlarging inguinal and femoral herniae owing to the fixity of the peritoneum at the umbilicus The enlarging sac splits and gets blown out into diverticula lined by fibrous tissue Any large umbilical hernia is loculated and its contents are adherent. Omentum is an invariable content but transverse colon is usually found as well and in large herniae coils of jejunum.

A small umbilical hernia is seldom seen because it is symptomless and buried in the subcutaneous fat of the abdominal wall A larger one is a diffuse oval swelling set transversely with the umbilical scar a little below its summit It is seldom reducible even in part As it enlarges further the umbilicus gets deeper and narrower and its secretions are apt to be retained and to become infected. Infection due to intertrigo also develops in the deep groove that appears between the overhanging swelling and the abdominal wall below it

Such herniae are dangerous but it is difficult to persuade the fat complacent grandmothers who possess them of the danger They cannot be controlled by a truss They increase steadily in size and the bigger they become the more likely are they to strangulate Strangulation in an umbilical hernia has a high mortality owing to the age and physical condition of the patients the number of bands and the loculi that are to be found in the sac and the frequency with which the strangulated loop is in the upper jejunum

For these reasons repair by operation is usually advisable even though the patient is not an ideal subject for anaesthesia Local anaesthesia would be desirable but adequate field block is seldom possible owing to the abundant fat on the abdominal wall and layer by layer infiltration as the operation advances may be required

MAYO'S OPERATION

The overlap method of repair of umbilical hernia introduced in 1893 by W J Mayo is almost unique among surgical procedures in that it has remained unchallenged and unimproved since its introduction It is founded upon the observation that the pull on the aponeurotic structures in the mid-line of the abdomen is transverse so that an incision placed transversely lies in the plane of stress and is not exposed to disruption

The skin incision

The umbilicus should always be excised It is unsightly and septic and its loss in this age group will not lead to any complexes The incision should be a wide transverse ellipse including the umbilicus and as much skin in a vertical plane as will clearly be redundant and extending laterally at any rate as far as the rectus muscles (Fig 49) The incision is carried down to the aponeurotic layer, and the ellipse of skin and fat is dissected off this layer from all sides towards the umbilicus until the fibrous neck of the sac is reached A large vessel piercing the rectus sheath on each side will require ligature

Treatment of the sac

The whole mass of skin, fat and hernia is held up in one hand while the neck is cut round with a sharp knife parallel to the abdominal wall and about ½ in beyond it As the fibrous strands are divided, others are put on the stretch and divided in turn, till the peritoneal neck of the sac is free of its aponeurotic sheath. The peritoneum is opened cautiously at the same level for it is only at the neck that the sac is likely to be free from adhesions As soon as an opening has been made the points of a pair of Mayo scissors are introduced through it and worked round between the sac and its contents snipping each part that has been shown to be free until the whole neck is divided The plane having been established, the opening is enlarged under direct vision, and working from within, the contents are pulled out of the sac By working from free space to adhesions by ligaturing adherent omentum and dissecting adherent wall off intestinal loops that are stuck to it this clearance can be done safely and the contents can be replaced in the abdomen after complete haemostasis has been secured

If the opening in the peritoneum is not much more than an inch across the peritoneal edges should be dissected free from the abdominal wall on each side and the hole should be closed with a continuous catgut suture If the opening is larger or if it is necessary to complete

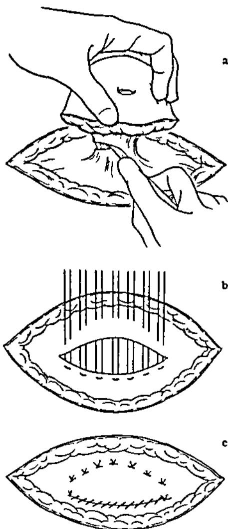


FIG 49 The Mayo operation for umbilical hernia

(*a*) The skin incision
(*b*) and (*c*) The vest over pants overlap

the operation expeditiously peritoneum and rectus sheath may be overlapped together

Repair of the aponeurotic layer

The opening remaining after removal of the sac is enlarged in a transverse direction by incising the rectus sheath on each side until the inner margins of the rectus muscles come into view thus converting a roughly circular opening into a transverse lozenge So that the opening when repaired, should be pulled together rather than apart by the lateral muscles the transverse length should be at least three times the vertical width. If extra width is needed when the muscles have been reached the anterior sheath only may be incised and included in the lateral part of the overlap

The lower flap is drawn under the upper by a series of mattress sutures of No 1 catgut The first suture *is passed through the upper* flap from without inwards while a finger protects the structures behind, *1½ in. above the free edge and ½ in. from the mid-line* It then passes through the edge of the lower flap from within outwards back *through the same edge from without inwards ½ in. on the other side* of the mid-line and out through the upper flap from within outwards *at the same distance from the edge and ½ in from its point of entry* The ends of the stitch are held in haemostats

A *further series of mattress sutures are placed in a similar manner* on each side of the mid-line area the mattresses being about ½ in apart and each subsequent one *a lesser distance from the edge as the corners* are approached When these sutures are tied the lower flap is drawn under the upper one *in a broad tongue*

The free edge of the upper flap is sutured under moderate tension *to the aponeurosis below the opening by a continuous stitch of catgut*

The skin flaps are closed with a series of mattress sutures of stout *nylon, the skin edges being approximated between them with stitches* of fine nylon. If there has been oozing during the operation, or any sepsis beforehand *a small corrugated drain* should be led down to the aponeurotic layer between two stitches and removed in forty-eight hours

Very large herniae

Sometimes the hernia is a group of two or three adjacent defects in the linea alba The *Mayo overlap* still offers the best means of repairing

such a hernia but the overlapped flaps are of poor quality In such cases strips of fascia lata may be darned backwards and forwards across the repair in a vertical direction taking their anchorage in the rectus sheath where it is undoubtedly sound

Preservation of the umbilicus

Within the last two years I have been preserving the umbilicus when the hernia is not really large and when the skin is uninfected The incision as for the operation in infants is a transverse one above the umbilicus and the skin of the umbilicus is kept in contact with the aponeurosis by a ball of wool applied under the dressing The cosmetic result is certainly better than the dented-in look of the abdomen in which an ellipse has been excised.

EPIGASTRIC HERNIA

Epigastric hernia resembles in many ways the umbilical hernia of adults but the clinical features are different It is commoner in men under 40 The patients are not necessarily overweight and the hernia has been noticed because of pain, either in the lump itself or epigastric pain of the duodenal ulcer type associated with meals and relieved by taking further food

The hernia is usually small about half way between the umbilicus and the xiphisternum and it is often felt more easily than seen. Like the adult type of umbilical hernia it protrudes through a chink in the linea alba It appears to be preceded by an extrusion of extra-peritoneal fat and the various conditions that are found suggest such a development There may be a localized lipoma only coming from the extra-peritoneal fat but containing no peritoneal sac a lipoma outside the aponeurosis with a small sac that does not protrude through it and a fully developed hernial sac Few epigastric herniae give an impulse on coughing or are reducible and they are recognized by the discovery in a patient complaining of epigastric pain of a tender fatty swelling in the mid-line At operation the sac is usually found to be empty or to contain a fringe of omentum only

Two explanations have been advanced for the association of epigastric hernia with digestive disturbances the mechanical—that a tag of omentum caught in the hernia is dragged upon by the contractions of the pyloric antrum in the later stages of gastric digestion, and

the reflex—that a gastro-peritoneal reflex disturbs the neuro-muscular mechanism of digestion

Operation

An epigastric hernia is readily repaired by a transverse overlap operation of the Mayo type Since however, the patient has usually presented himself on account of the pain rather than in order to have a hernia repaired, the surgeon is usually anxious to combine the repair with a laparotomy For this reason a longitudinal reconstruction is usually preferred

A 3-in incision with the lump at its centre is made in the mid-line and deepened through the linea alba above and below the hernial orifice The peritoneum is opened, either by excising or incising the sac and the cut is extended to allow inspection and palpation of the abdominal contents

The peritoneal layer is closed by a continuous everting stitch of No 0 catgut The rectus sheath on each side is then opened at its inner edge to a level ½ in above and below the mid-line cut and the two aponeurotic edges thus constructed are sewn together by continuous sutures of No 1 catgut to constitute an anterior and a posterior rectus sheath (Fig 50)

HERNIA IN THE LINEA SEMILUNARIS (*SPIGELIAN HERNIA*)

Like epigastric hernia Spigelian hernia is often small and silent and remains unrecognized till it becomes painful or presents as a visible and palpable swelling

The hernial opening is in the aponeurotic layer where the internal oblique and transversalis muscles join at the outer border of the rectus The opening is small 0 5 to 2 cm in diameter and has rigid margins As in epigastric hernia an extrusion of extra-peritoneal fat seems to have preceded the peritoneal protrusion, and the sac is variable in size It may be empty or may contain omentum small intestine and occasionally large intestine The hernial swelling is covered by the external oblique aponeurosis

Spigelian herniae are almost unknown above the umbilicus as the muscular fibres of the transversalis here extend behind the rectus muscle They are commonest at the level of the semilunar fold of Douglas

that is half way between the umbilicus and the pubis The hernia that is described on page 28 as congenital direct inguinal hernia may be a variety of Spigelian hernia

The cause of Spigelian hernia is obscure They are probably not congenital They have been seen at the age of 10 but never in infants They are associated with adiposity but not to any obvious extent with trauma and they are not like femoral and umbilical herniae linked with repeated pregnancies The internal oblique and transversalis muscles where they become tendinous are seen to be arranged in little bundles between which chinks often appear Such a chink is commonly encountered in the MacBurney approach to the appendix the commonest level for a Spigelian hernia to be found. It is probable that the growth of extra-peritoneal fat into such a chink may form the starting point of such a hernia

The diagnosis of or rather the search for a Spigelian hernia is usually made on the history rather than the physical signs Strangulation may be the first indication, and the patient is presented as a case of obscure intestinal obstruction. More commonly the pain is localized to a point in the linea semilunaris and it is made worse by coughing or prolonged standing Often the patient himself has found the lump and he may have noticed that it varies in size sometimes even that he can reduce it with a gurgle

On examination, a typical hernia is sometimes found. It gives an impulse on coughing is reducible and when it is reduced the hole in the parietes can be felt More often the diagnosis must be made on the finding of a rounded tender lump that is in and not deep to the abdominal wall A Spigelian hernia never has the clear outline of an inguinal femoral or umbilical hernia because it is covered by the external oblique aponeurosis

Treatment

Operation is essential because the hernia cannot be controlled by a truss and owing to the rigid fascial opening it is liable to strangulate

The incision is a transverse one down to the aponeurosis The external oblique is split in the line of its fibres to expose the hernia The neck of the sac is dissected out of its coverings as in umbilical hernia the sac is emptied and the neck is ligatured and cut off The musculo-aponeurotic layers forming the opening are closed in a transverse direction with an overlap as in umbilical and epigastric herniae

CHAPTER 9

Incisional Hernia

An incision or wound in the abdominal wall is a solution of continuity in a musculo-aponeurotic structure exposed to constant and fluctuating stresses to the constant stress of muscle tone and the thrust of the intra-abdominal pressure which that tone maintains to the regularly recurring contractions of respiratory movements and to the irregular and sometimes violent contractions which it undergoes in work and play as the chief motor group of the trunk. *At the time of repair the* strength of the wound is merely that of the stitches that hold it together The gap is bridged by the normal mechanisms of the body with a speed that varies with the site of the wound the accuracy of apposition, the age and health of the patient and the presence or absence of sepsis First dead tissues are removed by phagocytosis and the gap is filled by coagulated serum and blood clot then the clot becomes converted *into granulation tissue by the invasion of fibroblasts and capillary loops* then the granulation tissue is converted into connective tissue at first cellular and vascular later fibrous and avascular A sutured wound *healing without sepsis has about 40 per cent of the strength of the tissues* of the part after four days and about 90 per cent at ten days At ten days a scar that has healed by first intention will not be injured by normal use within the limits imposed by the *normal inhibitory reflex* of pain but it is not strong enough to stand maximal strains for about three months

Herniation in the scar of an abdominal incision is due to stretching of the connective tissue binding the edges of the wound together while it is still plastic that is while it still consists largely of fibroblasts rather than of adult connective tissue The causes are haemorrhage and sepsis shortly after repair by increasing the gap between the edges of the wound and by interfering with the formation of healthy granulation tissue anaemia or malnutrition, by slowing down the process of repair tympanites or ascites by subjecting the healing wound

to stretching and unskilled suture or the use of poor materials Herniation is particularly common after the use of certain incisions All vertical incisions in the rectus sheath and particularly the pararectal incisions such as Battle s are liable to yield if there is any adverse factor during convalescence because they cut across aponeurotic planes at right angles to the main stresses Transverse incisions rarely give way in civil surgery particularly those in the lateral segments of the abdominal wall but transverse incisions used to approach the abdominal injuries of warfare were not successful The para-costal or Kocher s incision usually heals well The lateral oblique incision of Rutherford Morrison is particularly liable to herniation because the internal oblique which at this level is the strongest layer consists of stout fleshy fibres that hold stitches badly when cut across

The margins of an incisional hernia are a rim of tough felted fibrous tissue where the constituent layers have been fused in the process of repair The defect is bridged by a thin layer of stretched fibrous tissue covering a layer of peritoneum to which the underlying viscera are to some extent adherent The whole is covered by skin bearing the stretched and adherent scar of the operation.

The characters and clinical features of an incisional hernia vary with its size If the whole incision has given way the hernia is a wide bulge that has no neck, is unlikely to strangulate and can usually be controlled by a simple belt or one with a pad corresponding to the defect it is little more than an extension of the abdominal cavity and does not cause symptoms If the incision has given way in part only the hernial opening is a rigid aperture in scar tissue through which the peritoneum bulges so that the hernia overlaps its orifice and assumes a mushroom shape The stretched peritoneum tends to form pockets like those encountered in umbilical hernia and strangulation is not unlikely

A large incisional hernia presents no problem in diagnosis A small one is often invisible being buried in subcutaneous fat and it is discovered because the patient complains of local pain in the scar or generalized colic The discovery of a rounded tender lump in the line of the incision clinches the diagnosis Such a hernia is not often reducible owing to the disproportion between the size of the sac and the opening in the parietes An incisional hernia often contains nothing but omentum and is symptomless It resembles a lipoma but it is anchored deeply which a lipoma is not and it underlies a scar which a lipoma never does

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Incisional Hernia

An incision or wound in the abdominal wall is a solution of continuity in a musculo-aponeurotic structure exposed to constant and fluctuating stresses to the constant stress of muscle tone and the thrust of the intra-abdominal pressure which that tone maintains to the regularly recurring contractions of respiratory movements and to the irregular and sometimes violent contractions which it undergoes in work and play as the chief motor group of the trunk At the time of repair the *strength of the wound is merely that of the stitches that hold it together* The gap is bridged by the normal mechanisms of the body with a speed that varies with the site of the wound the accuracy of apposition the age and health of the patient and the presence or absence of sepsis First dead tissues are removed by phagocytosis and the gap is filled by coagulated serum and blood clot then the clot becomes converted into granulation tissue by the invasion of fibroblasts and capillary loops then the granulation tissue is converted into connective tissue at first cellular and vascular later fibrous and avascular A sutured wound healing without sepsis has about 40 per cent of the strength of the tissues of the part after four days and about 90 per cent at ten days At ten days a scar that has healed by first intention will not be injured by normal use within the limits imposed by the normal inhibitory reflex of pain but *it is not strong enough to stand maximal strains* for about three months

Herniation in the scar of an abdominal incision is due to stretching of the connective tissue binding the edges of the wound together while it is still plastic that is while it still consists largely of fibroblasts rather than of adult connective tissue The causes are haemorrhage and sepsis shortly after repair by increasing the gap between the edges of the wound and by interfering with the formation of healthy granulation tissue anaemia or malnutrition, by slowing down the process of repair tympanites or ascites by *subjecting the healing wound*

towards the sac till the margins of the defect are clearly defined all round The sac is then opened and the redundant peritoneum is removed leaving a margin ½ in. wide on each side for suture Adherent coils can easily be freed from within once the sac is open. The exact margins of the defect can be identified by palpation between a finger in the sac and a thumb outside it

Before proceeding further the surgeon must determine by seizing the edges of the defect with Ochsner forceps and pulling them together the tension to which his repair will be subject If it is greater than sutures of No 1 catgut can be expected to withstand he will be wise to abandon the attempt to close the defect in layers and to rely on the ability of the tough fibrous edges to hold fascial sutures After suture of the peritoneum with catgut as a separate layer the edges of the gap are approximated by a continuous suture of fascia lata strips closely spaced A second layer of fascial sutures is laced across the first taking a bite of the aponeurosis ½ in. from the edge of the gap

Layer reconstruction of the defect

If the previous incision was one through the rectus sheath a series of tension sutures of stout silkworm gut or nylon each guarded with an inch of fine rubber tubing are passed through all layers of the abdominal wall across the gap an inch apart and an inch from the edge The ends of the sutures are secured with haemostats The edge of the defect is held between finger and thumb of the left hand and split with a sharp knife till the fibres of the rectus muscle are exposed (Fig 50) Scissors are inserted into the rectus sheath and the cut is extended up and down as close to the margin of the defect as the muscle fibres extend splitting the wall into two fibrous layers with the rectus muscle between them The opposite side of the defect is treated in the same way and the cuts are extended ½ in above and below the ends of the hernial defect into the rectus sheaths where they are normal The two inner margins of the cuts are then sutured across the gap with interrupted sutures of No 1 catgut and the outer layers are then sutured in the same way thus reconstituting a posterior and anterior rectus sheath Finally the tension sutures are tied thus taking all strain off the catgut sutures

The skin edges are apposed and everted between the tied tension sutures by interrupted stitches of fine nylon. The fine stitches are removed after six days The tension sutures remain for ten days

Treatment

A large incisional hernia is not dangerous Whether it is inconvenient or not depends on the personality and occupation of the patient The choice between a belt and operative repair is therefore a matter for discussion. All incisional herniae can be repaired and most healthy and sensible patients would rather have an operation than be condemned to a lifetime in harness

Small herniae are a real danger They cannot be controlled by apparatus and they are liable to strangulate Operation must be advised unless there is some cogent contra-indication.

OPERATION

The only satisfactory repair of an incisional hernia is by the suture of living tissues *Nothing is missing and though the scar has stretched,* healthy muscles lie on each side of it and can be brought together Only when portions of the abdominal wall have actually been removed as in operations for cancer, is there any need to use implants of foreign material

On the other hand most patients with incisional hernia are fat often grossly so and it is futile to attempt repair till they have by dieting been brought back to the average weight for their age and build Fat increases the width of the defect and the bulk of abdominal contents that are thrusting against it It also infiltrates all fibrous planes including those that must be brought together and destroys their ability to hold stitches

The incision

An elliptical incision encircling the scar of the previous operation is used The width of the ellipse should be such that the skin edges meet after repair of the hernia without tension and without redundancy *The incision is deepened till a cleavage plane is encountered between* the sac and the subcutaneous fat and this plane is followed until the aponeurotic layer is reached on each side *The ellipse of skin and* subcutaneous tissue is then cut away In dissecting the adherent scar from the underlying peritoneum care must be taken not to injure *adherent bowel*

The dissection is now continued in the plane of the aponeurosis

REALLY LARGE DEFECTS

Occasionally the hole is so large or the hernia has been present so long that repair by suture of living tissues seems to be impossible More often the difficulty is due to the removal of large sections of the abdominal wall that have been involved by a malignant tumour

Ten years ago I was obliged to resect the whole right lower quadrant of the abdominal wall for a cancer of the colon that had been fungating for three years but yet had not metastasized widely I bridged the huge gap with two layers of tantalum gauze anchored to the normal tissues on each side with interrupted sutures of tantalum wire but covered only by skin and subcutaneous tissue and backed only by great omentum The tantalum gauze is seen in a film to have fragmented extensively but the repair seems to be as sound as ever and the patient became mayor of an important town

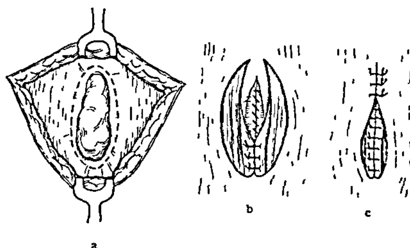


FIG 50 Repair of incisional hernia in the rectus sheath

(a) The margins of the defect are incised
(b) The inner margins of the incisions are sutured to each other above the closed peritoneum
(c) The outer margins of the incisions are sutured to reconstitute an anterior rectus sheath

In herniae occurring in oblique or gridiron incisions the external oblique muscle which was divided in the line of its fibres is usually *found to be stretched over the defect but not separated The planes* should be identified outside the area of the hernia The external oblique fibres should be split in the line of the previous incision and separated from the internal oblique layer and the separation should be continued for the length of the incision reflecting the external oblique inwards and outwards as flaps and exposing the hernial defect in the deeper layers

The internal oblique and transversalis muscles will usually be found to be fused together by repair and they can be treated like the rectus sheath, being split into two fibrous layers which are separately repaired by interrupted sutures of catgut

In the case of a gridiron incision that was too large to start with and has given way widely difficulty may be found in closing the inner end of the gap in the deeper muscles at the outer border of the rectus Here a short darn with fascial sutures or strips taken from the external oblique will usually provide the requisite security

remembered that these cases are discovered only when they give rise to symptoms

The commonest clinical picture is one of acute intestinal obstruction of unknown origin due to strangulation of a loop of small intestine in the neck of the sac. The strangulated loop is usually small and because of the small size and rigid margins of the opening it often involves part of the intestinal wall only (Richter s hernia) and early gangrene and perforation are common

There is often a history of vague abdominal symptoms accompanied by pain felt along the inner side of the thigh and knee This association of intestinal symptoms with pain referred to the cutaneous distribution of the obturator nerve should prompt the search for an obturator hernia but the diagnosis is seldom made till the onset of strangulation points to the explanation of the earlier symptoms

Very rarely a lump is noticed by the patient More often the surgeon, seeking for an explanation of obturator pain notices a slight fullness to the inner side of the femoral vessels compared with the other side

The lump of an obturator hernia since it lies deep to the pectineus muscle is much less definite in outline than a femoral hernia and it becomes even less defined when the muscles are contracted If the hernia is a large one it may give an impulse on coughing and be reducible with a gurgle but these signs are exceptional The obturator opening can be palpated from the vagina or the rectum and if a hernia is present an entering loop of gut may be felt or the neighbourhood of the opening may be tender

Treatment

The treatment of obturator hernia is by operation. In most cases since the hernia presents as an acute abdominal emergency operation comes first and diagnosis follows Even if the diagnosis is made in a symptomless period operation must be advised since strangulation is an ever present risk.

Two approaches to the obturator canal are described from the abdomen and from the thigh The second is difficult and dangerous and has nothing to recommend it

Operation

The abdominal cavity is opened by a mid-line incision below the umbilicus extending down to the pubis When it is seen that an

CHAPTER 10

Herniae in the Pelvic Region

The number of possible herniae is almost unlimited Wherever a nerve or a blood vessel passes through the abdominal walls wherever a muscle arises, is inserted or changes from fleshy to tendinous fasciculi a pouch of peritoneum may be forced out by excessive prolonged, or repeated abdominal pressure The only unusual herniae that are encountered with any frequency are those in the pelvis and of these only obturator hernia is reasonably common The importance of these herniae is that they are often unrecognized till they strangulate

OBTURATOR HERNIA

Obturator hernia is a hernia through the obturator canal a small channel between the horizontal ramus of the pubis above and the upper border of the thyroid membrane below that transmits the obturator nerve and vessels through the upper part of the thyroid foramen. The thyroid membrane closes the foramen except for this channel it gives origin on its medial aspect to the obturator internus muscle and on its outer aspect to the obturator externus

The hernial sac is usually a small protrusion of parietal peritoneum that is neither visible nor palpable The neck of the sac lies to the inner side of the obturator artery and nerve The fundus in most cases lies between the pectineus muscle in front and the obturator externus behind but it may present between fasciculi of the obturator externus or rarely lie between that muscle and the thyroid membrane

Obturator hernia is unknown in children and is very rare under the age of 20 It is six times as common in women as in men, a fact which suggests that like femoral hernia it is due to the strains of labour The maximum incidence in reported series is between the ages of 50 and 70 that is beyond the age of child bearing but it must be

enters and distends the labium majus Posterior perineal hernia presents behind the transversus perinei muscle through a separation in the fibres of the levator ani muscle It is seen as a swelling to the side of the anus or it may bulge into the anterior rectal wall Eighty per cent are in women

A perineal hernia is usually seen as an obvious swelling presenting few urgent symptoms in an ageing woman who looks upon it as one of the lesser afflictions in a life of drudgery and repeated child-bearing The swelling gives an impulse on coughing and is easily reducible but returns as soon as the pressure of the hand is removed The contents usually include bladder and the patient is often aware that she must support the swelling with her hand in order to empty the bladder completely

Treatment

A skilled instrument maker can design a truss to support the swelling by a pad held in position by elastic straps but the apparatus is always irksome it is apt to excoriate the skin, and it must be removed for urination and defaecation.

Operative repair is usually performed by the abdominal route with the patient in the Trendelenburg position. The sac is inverted into the abdomen and the peritoneum is dissected off the defect in the pelvic floor which is defined, and closed in the line of the separated muscle fibres by interrupted sutures of stout catgut Any fascial layers that can be identified are approximated over the suture line as additional reinforcement. If thought advisable an additional layer of fascial sutures taken from the external oblique aponeurosis may be added. Finally the peritoneum of the sac wall is overlapped to provide additional security

SCIATIC HERNIA

Herniation through the great or the lesser sciatic foramen is very rare Unlike obturator and perineal hernia it does not appear to be associated either with labour or with excessive exertion. Ten per cent of the cases reported have been in infants and the numbers in the two sexes are approximately equal

The hernia is usually through the upper part of the great sacro-sciatic foramen, the sac coming out of the pelvis above the pyriformis

obturator hernia is present the patient is tilted into the Trendelenburg position. If bowel is in the hernia it is gently extracted and the loops of intestine are packed out of the way to expose the hernial orifice

In most cases the small empty sac can be inverted into the abdomen by *seizing the fundus from within* with a haemostat Radical closure of the canal a rigid opening between bone and ligament transmitting a nerve and an artery, is out of the question The best safeguard against recurrence is to convert the peritoneal hollow into a peritoneal hummock Through an incision in the neck of the sac, the empty canal is filled with a free transplant of subcutaneous fat from the abdominal wall The inverted sac is then converted by a few stitches of catgut into a flat tampon or rivet head that lies over the fat transplant as a further protection.

PERINEAL HERNIA

A perineal hernia is a protrusion of the peritoneum of the recto-vesical pouch through the musculature of the pelvic floor It is almost limited to women It occurs between the ages of 40 and 60 and is attributed to the strain of repeated or complicated pregnancies Two varieties are described the anterior and the posterior (Fig 51)

Anterior perineal hernia is a protrusion in front of the transversus perinei muscle and is seen only in women The hernia as it enlarges

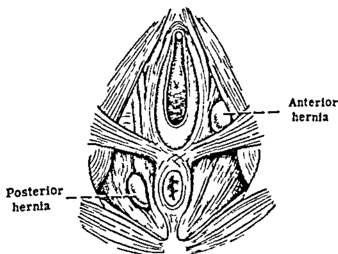


Fig 51 Perineal hernia

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muscle and in front of the sciatic nerve It is covered by the gluteus maximus and as it enlarges it extends downwards and finally presents at the lower border of the muscle

The clinical picture has many similarities to that of obturator hernia —that is the patient may present himself for three reasons because he has vague abdominal discomfort accompanied by pain referred among the distribution of the sciatic nerve, because he has observed a reducible lump or because of an unexplained attack of acute intestinal obstruction Strangulation however is much rarer than in the case of obturator hernia

Operation

The treatment of sciatic hernia is along the same lines as that of obturator hernia and for the same reasons Control by a truss is impossible the risk of strangulation can never be dismissed and operative repair from the buttock is difficult and unsatisfactory Laparotomy is therefore essential

With the patient in the Trendelenburg position, the abdomen is opened by an infra-umbilical mid-line incision The hernial opening is displayed and the sac is inverted into the abdomen by grasping the fundus with a haemostat The peritoneum is incised at the neck to display the hernial opening above the pyriformis muscle and the canal is filled with a free transplant of subcutaneous fat sufficient to project beyond the pelvic wall into the retroperitoneal space The sac is tied off and cut away or converted by catgut sutures into a flat washer that covers the site of the former hernial opening

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